U
408.3
.A1
FM 6-94
C 1,
Reference
15 May 68

FM 6-94

DEPARTMENT OF THE ARMY FIELD MANUAL

Reference

175-mm GUN M107 SELF-PROPELLED AND 8-INCH HOWITZER M110 SELF-PROPELLED

HEADQUARTERS, DEPARTMENT OF THE ARMY
NOVEMBER 1962

FIELD MANUAL No. 6–94

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *5 November 1962*

175-MM GUN M107, SELF-PROPELLED, AND 8-INCH HOWITZER M110, SELF-PROPELLED

		Paragraphs	Page
CHAPTER	1. GENERAL	1–4	3
	2. ORGANIZATION	5, 6	8
	3. SECTION DRILL		
Section	I. General	7, 8	13
	II. Preliminary commands and formations	9–14	14
CHAPTER	4. PREPARING THE PIECE FOR FIRING AND TRAVELING		
Section	I. Preparations for firing	15, 16	21
	II. Preparations for traveling	17, 18	22
CHAPTER	5. FIRING BY INDIRECT LAYING		
Section	I. General	19, 20	24
	II. Duties of chief of section	21–36	26
	III. Duties of gunner	37–46	33
	IV. Duties of assistant gunner, cannoneers, and driver	47–88	37
CHAPTER	6. FIRING BY DIRECT LAYING		
Section	I. Technique of fire	89–95	52
	II. Duties of chief of section	96–103	58
	III. Duties of gunner, assistant gunner, cannoneers, and driver	104–107	63

		Paragraphs	Page
CHAPTER 7.	MISCELLANEOUS PROCEDURES AND TECHNIQUES	108–117	68
8.	BORESIGHTING		
Section I.	General	118–121	81
II.	Testing target method	122–125	84
III.	Distant aiming point method	126, 127	87
IV.	Standard angle method	128–131	88
V.	Aiming circle method	132–135	93
CHAPTER 9.	BASIC PERIODIC TESTS		
Section I.	General	136, 137	103
II.	Test of gunner's quadrant	138–142	105
III.	Test of telescope mount, M137, panoramic telescope, and elevation quadrant M15	143–149	107
IV.	Test of fuze setters	150–152	113
CHAPTER 10.	MAINTENANCE AND INSPECTIONS	153–162	115
11.	DECONTAMINATION OF EQUIPMENT	163–166	120
12.	DESTRUCTION OF EQUIPMENT	167–170	123
13.	SAFETY PRECAUTIONS	171–175	125
14.	TRAINING		
Section I.	General	176–179	128
II.	Minimum training schedule	180–182	130
CHAPTER 15.	TESTS FOR QUALIFICATION OF GUNNERS		
Section I.	General	183–190	135
II.	Tests	191–200	138
APPENDIX.	REFERENCES		158
INDEX			161

CHAPTER 1
GENERAL

1. Purpose and Scope

This manual is a guide to assist commanders in developing the sections of 175-mm gun M107 and 8-inch howitzer M110 firing batteries into efficient smooth-working teams with a sense of discipline that will impel them to operate effectively under the stress of battle. This manual prescribes individual duties and section drills, tests and adjustments for sighting and fire control equipment, and instructions for the destruction and decontamination of equipment. The material contained herein is applicable, with modification, to both nuclear and nonnuclear warfare.

2. Definition of Terms

a. Section. Tables of organization and equipment (TOE's) prescribe the *personnel* and *equipment* which comprise each section of a battery. In this manual the term *section* is often used to designate *only the personnel* required to serve the weapon and its equipment. Appropriate TOE's authorize a section vehicle for each section.

b. Front. The front of a section is the direction in which the muzzle of the gun (howitzer) points.

c. Right (Left). The direction right (left) is the right (left) of one facing to the front.

d. In Battery. A gun (howitzer) is said to be in battery when the recoiling parts are in the normal firing position.

3. Description of Equipment

The motor carriages of the 175-mm gun M107 (fig. 1) and the 8-inch howitzer M110 (fig. 2) are identical. The singular difference in the weapons are the tubes. To insure proper use of the motor carriage and to avoid accidents caused by exceeding its capabilities and limitations, all members of the section should be familiar with the performance characteristics shown in figure 3. For further details pertaining to fulltrack vehicle capabilities and combat driving, see TM 21–306.

4. References

Publications covering related matters which are not discussed in detail in this manual are listed in the appendix.

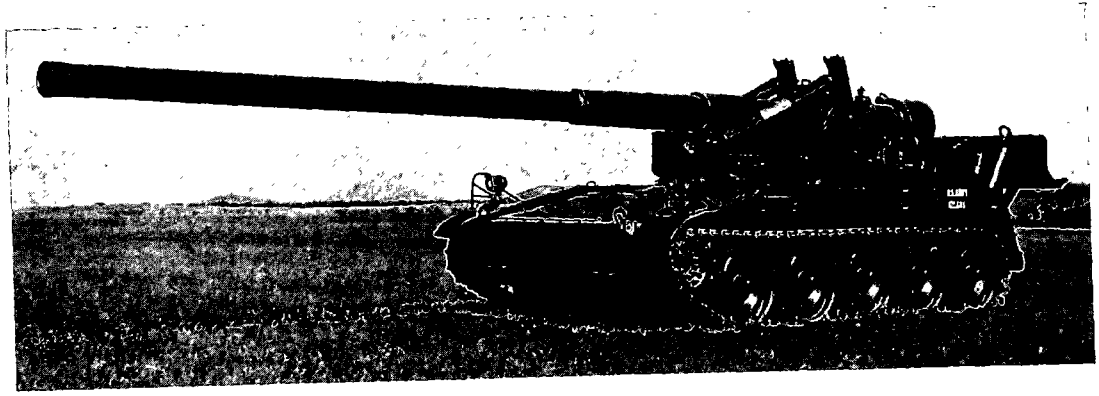


Figure 1. 175-mm gun M107, self-propelled.

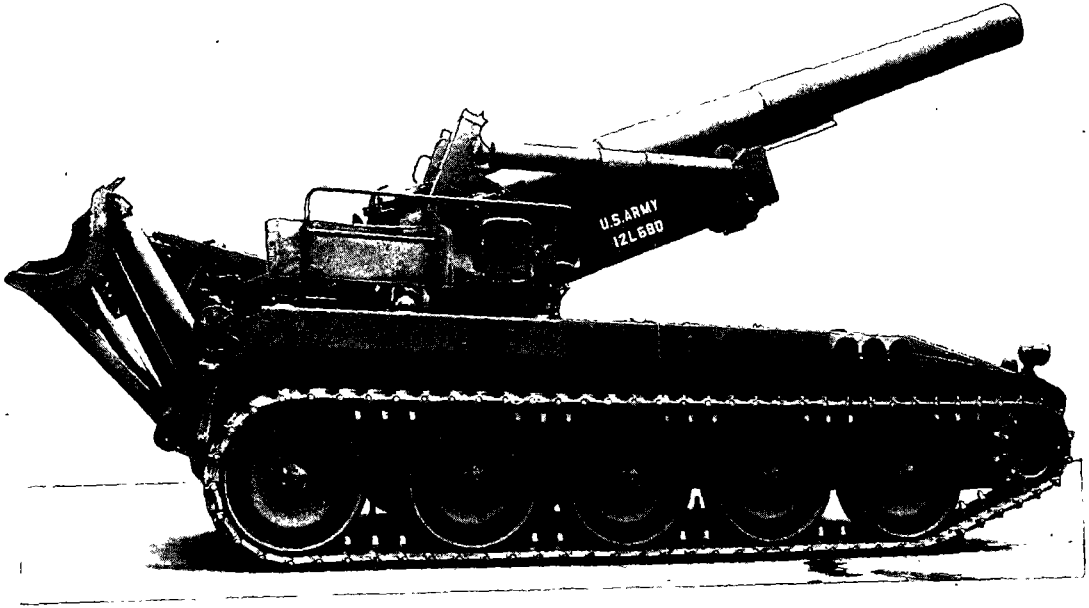
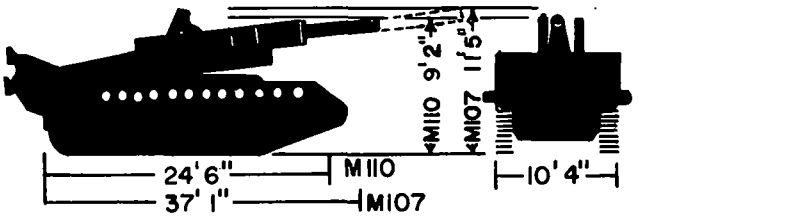


Figure 2. 8-inch howitzer M110, self-propelled.



FORDING DEPTH	GRADIENT	CRUISING SPEED	VERTICAL OBSTACLE	BRIDGE CLASS	TRENCH
42"	42 DEGREES	20 MPH	40"	M110: 30 TONS M107: 32 TONS	7'5"

Figure 3. Performance characteristics of the motor carriage, 175-mm gun M107 and 8-inch howitzer M110.

CHAPTER 2
ORGANIZATION

5. Composition of Gun (Howitzer) Section

a. The gun (howitzer) section consists of section personnel; a 175-mm gun M107, self-propelled, or an 8-inch howitzer M110, self-propelled; a section vehicle; and auxiliary equipment (figs. 4 and 5).

b. Personnel of the gun (howitzer) section consist of—

(1) A chief of section (CS).
(2) A gunner (G).
(3) An assistant gunner (AG).
(4) Eight cannoneers, numbered 1 through 8.
(5) A motor carriage driver (MD).
(6) A section vehicle driver (SD).

c. Section equipment is listed in appropriate TOE's (app.).

6. General Duties of Personnel

a. Chief of Section. The chief of section is the noncommissioned officer in command of the section and as such, is responsible to the battery executive for—

(1) Training and efficiency of personnel.

Figure 4. 175-mm gun M107, self-propelled, and section personnel.

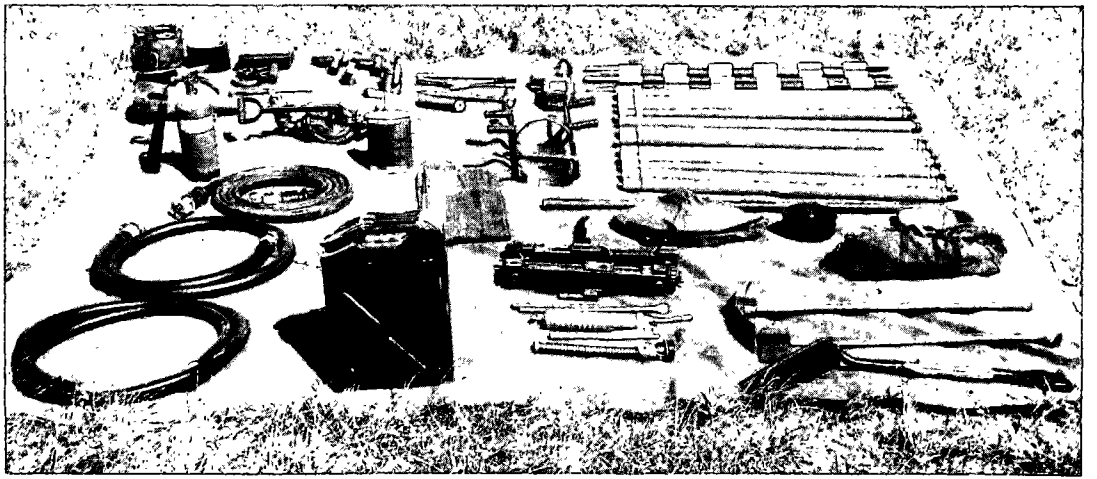


Figure 5. A method of displaying section equipment.

(2) Performance of duties in section drill, duties in firing, tests and adjustment of sighting and fire control equipment, and inspection and maintenance of all section equipment, including the performance of scheduled preventive maintenance service on the motor carriage and section vehicle.

(3) Observation of safety precautions.

(4) Preparation of field fortifications for protection of equipment, ammunition, and personnel.

(5) Camouflage discipline; local security; and chemical, biological, and radiological (CBR) warfare security discipline.

(6) Maintenance of the weapon record book.

(7) Police of the section area.

b. Gunner. The gunner is the principal assistant to the chief of section in performing the duties specified in *a* above. The gunner's specific duties are prescribed in the appropriate chapters of this manual.

c. Assistant Gunner. The assistant gunner assists the gunner in performing his duties and, in an emergency, acts as the gunner. The assistant gunner's specific duties are prescribed in appropriate chapters of this manual.

d. Cannoneers. Cannoneers perform the duties listed in this manual and any other duties assigned by the chief of section.

e. Drivers. The drivers' primary duties are driving their respective vehicles and performing

preventive maintenance. They also perform the duties prescribed by this manual and by the training manuals pertaining to their vehicles, and other duties assigned by the chief of section. These duties can include substituting for any member of the section in firing.

CHAPTER 3
SECTION DRILL

Section 1. GENERAL

7. Objective

The objective of section drill is the attainment of efficiency—maximum precision coupled with high speed.

8. Instructions

a. Adherence to drills prescribed in this manual is necessary to develop maximum efficiency and to prevent injury to personnel and damage to equipment. Section drill must be conducted in silence, except for commands and reports. The section must be drilled until reactions to commands are automatic, rapid, and efficient.

b. Errors are corrected immediately. Each member of the section must be impressed with the importance of reporting promptly to the chief of section any errors discovered before or after the command to fire has been given. The chief of section will report errors immediately to the executive.

c. Battery officers supervise the drill to insure that instructions are carried out and that maximum efficiency is obtained.

d. Duties should be rotated during training so that each member of the gun (howitzer) section can perform all the duties within the section. In addition, battery overhead personnel not assigned specific duties during drill periods should be trained in the fundamentals of section drill in order that they will be capable of functioning efficiently with a gun (howitzer) section if required.

Section II. PRELIMINARY COMMANDS AND FORMATIONS

9. To Form the Section

a. To Fall In. The chief of section takes his post. On the command of execution the section forms in a single rank, at close interval, centered on and facing the chief of section at a distance of 3 paces. Higher numbered cannoneers, if present, form in order between No. 8 and the motor carriage driver. The chief of section may indicate in his preparatory command the place and direction in which the section is to form. At the first formation for a drill or exercise, the caution "As gun (howitzer) section(s)" precedes the command. The commands are FALL IN, or 1. IN FRONT (REAR) OF YOUR PIECE(S), 2. FALL IN, or 1. ON THE ROAD FACING THE PARK, 2. FALL IN. Execution is as follows: The section moves at double time and forms at close interval, at attention, guiding on the gunner. The driver of the section vehicle is to the left of the motor carriage driver and is the last in line. To execute 1. IN REAR OF

YOUR PIECE, 2. FALL IN, the section falls in as shown in figure 6.

b. To Call Off. The section being in formation, the command is CALL OFF. At the command, all personnel in ranks, except the gunner, execute eyes right. The section then calls off in sequence; for example, "Gunner," "Assistant Gunner," "1," "2," "3," "4," "5," "6," "7," "8," "Driver," "Driver." Each man, except the gunner, turns his head smartly to the front as he calls out his designation.

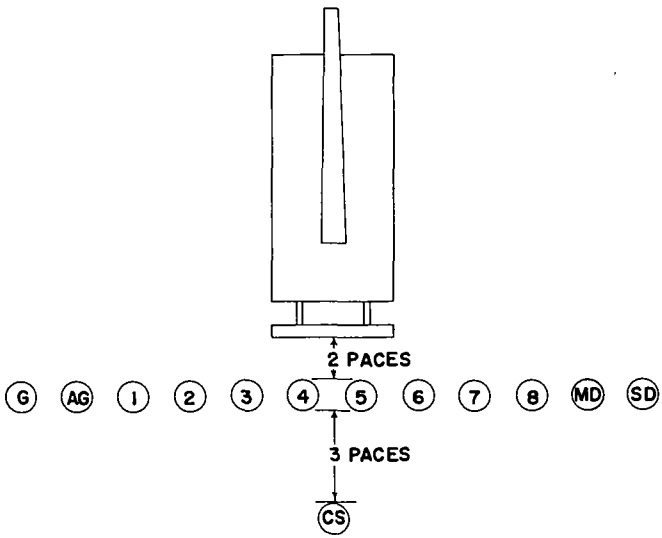


Figure 6. Formation of the section in rear of the piece.

10. To Post the Section

The command is 1. CANNONEERS, 2. POSTS. The command is general and is applicable whether the section is in or out of ranks, at a halt, or marching. All movements are executed at double time and are terminated at the position of attention. Higher numbered cannoneers, if present, take posts as prescribed by the chief of section.

a. Dismounted. The section moves to posts as shown in figure 7. All personnel are 2 feet outside the tracks and facing the front.

b. Prepared for Action. The piece having been prepared for action, the section is posted as shown in figure 8. All personnel face to the front.

11. To Change Posts

To acquaint the members of the section with all duties and to lend variety to drill, posts should be changed frequently. The section being *in formation* (fig. 6), the commands are 1. CHANGE POSTS, 2. MARCH, or 1. SECTION CHANGE POSTS, 2. MARCH.

a. At the command 1. CHANGE POSTS, 2. MARCH, all numbered cannoneers except No. 8 take two left steps, taking the position of the next higher numbered cannoneer. At the same time No. 8 moves at double time in rear of the rank to the post of the assistant gunner. All other members of the section stand fast.

b. At the command 1. SECTION CHANGE POSTS, 2. MARCH, all members of the section except the driver of the section vehicle (or the left most man

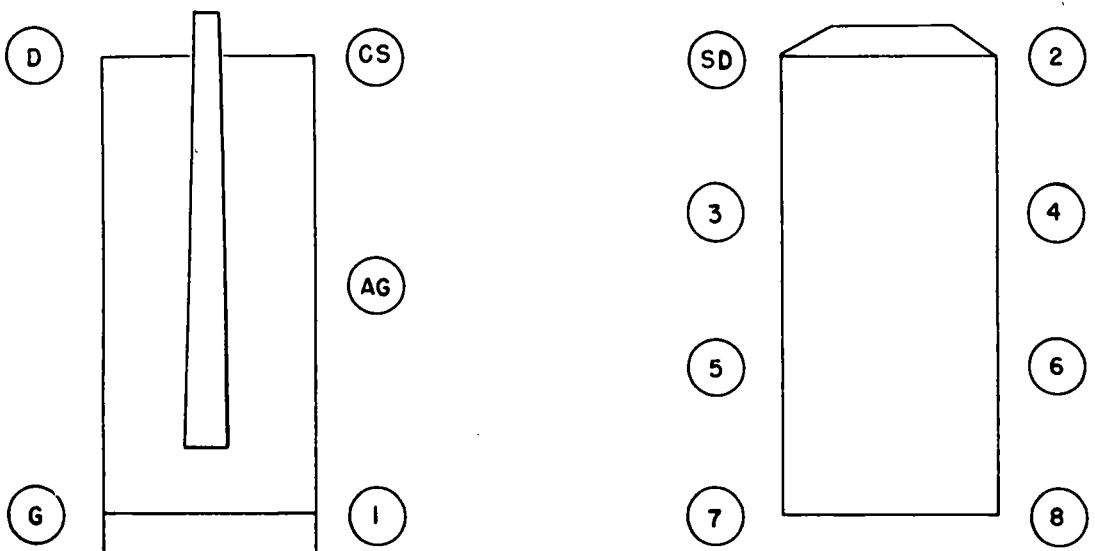


Figure 7. Posts of section dismounted.

in the rank) take two left steps. The driver of the section vehicle moves at double time in rear of the section and takes the post of the gunner.

12. To Mount

The commands are 1. PREPARE TO MOUNT, 2. MOUNT, or MOUNT.

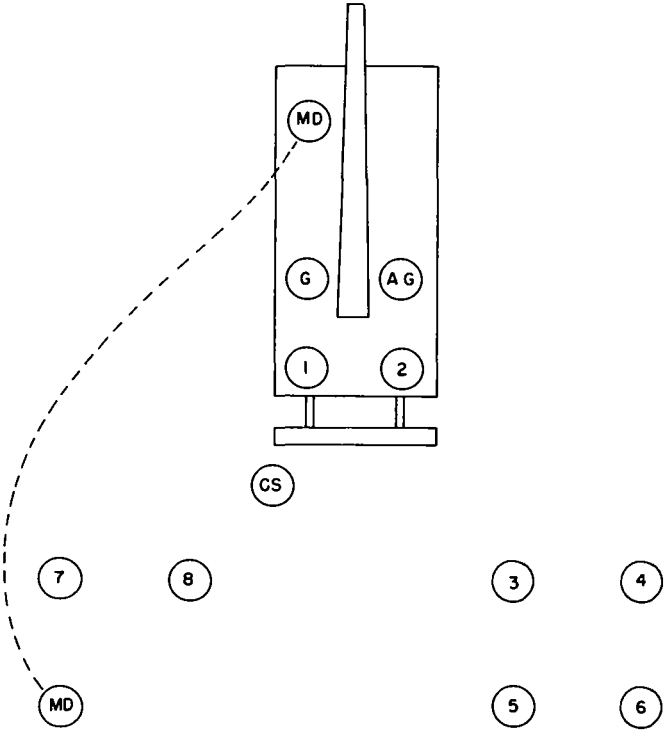


Figure 8. Posts of section prepared for action.

a. At the preparatory command, the section moves at double time to the positions shown in figure 7. At the command of execution, all personnel mount as indicated in figure 9. The chief of section, driver of the motor carriage, gunner, assistant gunner, and No. 1, mount on the motor carriage. Likewise, at the command of execution, the driver of the section vehicle, and No.'s 2, 3, 4, 5, 6, 7, and 8 mount into the section vehicle as shown in figure 9. If any members of the section are not to mount, their designation is announced with the caution, "Stand fast," given between the preparatory command and the command of execution. For example, 1. PREPARE TO MOUNT, DRIVERS STAND FAST, 2. MOUNT.

b. If the command is MOUNT, the section mounts in the manner and order prescribed for

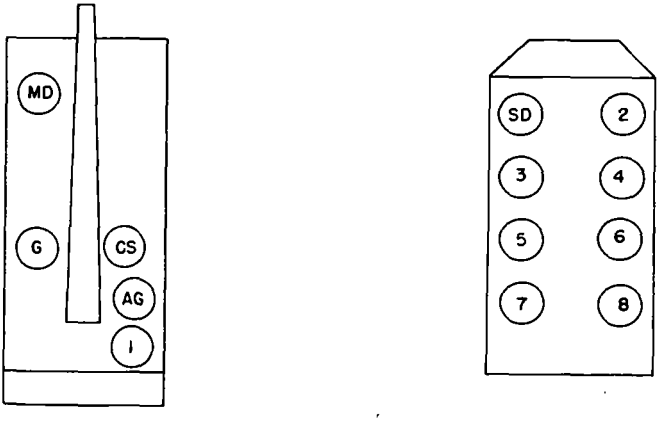


Figure 9. Section mounted.

the command 1. PREPARE TO MOUNT, 2. MOUNT. Dismounted posts are not taken.

13. To Dismount

The commands are 1. PREPARE TO DISMOUNT, 2. DISMOUNT, or DISMOUNT.

a. At the preparatory command, the personnel mounted in the section vehicle unlatch and open the doors (tailgate) of the vehicle and all members of the section assume positions from which they can dismount promptly. At the command of execution, they dismount and take the posts shown in figure 7 at double time.

b. If the command is simply DISMOUNT. the section executes all that is prescribed for the command 1. PREPARE TO DISMOUNT, 2. DISMOUNT.

14. To Fall Out

a. At Drill. When it is desired to give the personnel a rest from drill or to relieve them temporarily from *formation* or *post,* the command FALL OUT is given. The command may be given at any time and means that the section is to remain in the drill area.

b. When Firing. When firing has been suspended temporarily, but it is desired to have the section remain in the vicinity of the motor carriage, the command FALL OUT is given. Men stand clear of the piece to insure that settings and laying remain undisturbed. During these periods, the chief of section may direct the men to improve the position, to replenish ammunition, or to do other necessary work.

CHAPTER 4

PREPARING THE PIECE FOR FIRING AND TRAVELING

Section I. PREPARATIONS FOR FIRING

15. General

The weapons of a battery will ordinarily be moved into position individually under the direction of the executive and chiefs of section. A stake should be driven into the ground at a point where the center of each carriage is to be placed. Another stake should be placed in the direction of fire, 50 to 100 meters from the first stake, so that the driver of the motor carriage can point the tube at the far stake as he drives the vehicle into position over the first stake. Each vehicle is halted at its proper place by the chief of section. Hand signals for guiding the vehicle are found in FM 21–60, FM 25–10, and TM 21–306.

16. To Prepare for Action

a. The piece being in position or approaching it, the command is PREPARE FOR ACTION. Duties of individuals are given in table I. Each man takes his post (fig. 8) on completion of his duties.

Table I. Duties in Preparing for Action
(Located in back of manual)

b. The piece normally will be partially prepared for action before reaching the firing position. The duties of the cannoneers in preparing for action are the same whether the piece is moving or halted, but only the operations that are practicable are performed while moving. Immediately after the piece is established in position, preparation for action is completed without further command.

c. If PREPARE FOR ACTION has not been ordered before the piece is established in position, the command is habitually given by the chief of section as soon as the vehicle is halted in position. When preparation for action is not desired, the caution "Do not prepare for action" must be given.

Section II. PREPARATIONS FOR TRAVELING

17. March Order

To prepare to resume travel, the command is MARCH ORDER. Duties of individuals are given in table II. Each man takes his post (fig. 7) on completion of his duties.

Table II. Duties in March Order
(Located in back of manual)

18. To Resume Firing in Another Position

a. If the piece is to be moved a short distance and if firing is to be resumed promptly, the command MARCH ORDER is not given. When such a displacement is ordered, only those operations necessary for the movement of the motor carriage and the security of equipment are performed.

b. If the command MARCH ORDER is given while the weapon is prepared for travel as in *a* above, the operations pertaining to march order are completed.

CHAPTER 5

FIRING BY INDIRECT LAYING

Section I. GENERAL

19. Instructions

The general instructions in paragraphs 7 and 8 on the conduct of section drill apply equally to section drill in duties in firing by indirect laying. The sequence of duties performed in firing is shown in table III. For duties of the battery executive, see FM 6–40 and FM 6–140.

Table III. Duties in Firing
(Located in back of manual)

20. Duties of Individuals

In general, the duties of individuals in the section in indirect fire are given in *a* through *l* below. These duties apply to personnel of both the 175-mm gun and the 8-inch howitzer sections.

a. The chief of section supervises and commands his section and is responsible that all duties of the section are performed properly, all commands are executed, and all safety precautions are observed.

b. The gunner sets the announced deflection, lays for direction, refers the panoramic telescope, alines the aiming posts assisted by No. 6, operates

the power and/or manual traversing mechanism, and announces "Ready" when the piece is ready to be fired. From the gunner's position, it is possible for him to set the announced elevation and lay for elevation using the power elevating mechanism. However, these duties are not normally performed by the gunner.

c. The assistant gunner sets the announced elevation, lays for elevation, operates the power and/or manual elevating mechanism, and calls "set" when the piece is laid for elevation.

d. No. 1 operates the loader-rammer, receives the powder charge from Nos. 6 and 7, loads the powder charge assisted by No. 2, inserts the primer, and closes the firing lock.

e. No. 2 assists No. 1 in loading the projectile and the powder charge, removes the loading tray and passes it to No. 3, closes the breech, attaches the firing lanyard to the firing lock, and fires the piece. After firing, he opens the breech, swabs the powder chamber, inspects the bore, and calls "bore clear."

f. No. 3, assisted by No. 4, installs the projectile on the loading tray, straps the projectile to the tray, and attaches the loading tray to the loading arms. After the projectile and powder are loaded, No. 3 receives the loading tray from No. 2.

g. No. 4 assists in preparing ammunition and assists No. 3 in installing the projectile on the loading tray and attaching the loading tray to the loading arms.

h. No. 5 assists in preparing ammunition, fuzes the projectiles, and sets time assisted by No. 6.

i. No. 6 assists in preparing ammunition, assists No. 5 in fuzing projectile and setting time, and assists the gunner in alining the aiming posts.

j. No. 7, assisted by No. 8 and the prime mover driver, prepares powder charges and, assisted by No. 8, moves the powder charge to the rear of the piece and passes it to No. 1.

k. No. 8 assists in preparing powder charges and assists No. 7 in moving the powder charge to the piece.

l. The prime mover driver assists in preparing powder charges and shifts the carriage when directed to do so by the chief of section.

Section II. DUTIES OF CHIEF OF SECTION

21. List of Duties

Paragraph 22 through 36 contain description of duties.

22. Indicates the Aiming Point to the Gunner

When an aiming point has been designated by the executive (FM 6–140), the chief of section will insure that he has properly identified the point designated. He will then indicate this point to the gunner. If there is any possibility of misunderstanding, the chief of section will turn the panoramic telescope until the horizontal and vertical crosshairs are on the aiming point designated.

23. Measures the Angle of Sight to the Mask

a. The command is MEASURE THE ANGLE OF SITE TO THE MASK. The chief of section,

sighting along the lowest element of the bore, directs the gunner to traverse and elevate the tube until the line of sight just clears the crest at its highest point in the probable field of fire. The gunner then turns the elevation counter knob in the appropriate direction until the elevation level bubble is centered. The chief of section reads the elevation from the elevation counter dial and reports to the executive, "Sir, number (so-and-so), angle of site (so much)."

b. When the executive announces the minimum elevation and charge or the minimum elevation for each charge, the chief of section records the data in a notebook and directs the assistant gunner to chalk the information on a convenient place on the hull or on the section data board.

24. Follows Fire Commands

The chief of section will follow fire commands. He will repeat the commands as required.

25. Indicates When the Piece Is Ready To Be Fired

When the executive can see arm signals made by the chief of section, the chief of section will raise his right arm vertically as a signal that the piece is ready to be fired. He gives the signal as soon as the gunner calls "Ready." When arm signals cannot be seen, the chief of section reports orally to the executive, "Sir, number (so-and-so) ready."

26. Gives the Command to Fire

When No. 2 can see the arm signals made by the chief of section, the chief of section will give

the command to fire by dropping his right arm sharply to his side. When his arm signals cannot be seen, he commands orally number (SO–AND–SO), FIRE. The chief of section will not give the signal or command to fire until all cannoneers are in their proper places.

27. Reports Errors and Other Unusual Incidents of Fire to the Executive

If the piece cannot be fired, the chief of section will promptly report that fact to the executive and the reasons therefor; for example, "Sir, number (so-and-so) out; misfire." When it is discovered that the piece has been fired with an error in laying, the chief of section will report that fact at once; for example, "Sir, number (so-and-so) fired 40 mils right." When the gunner reports that the aiming posts are out of alinement, the chief of section will report that fact and, during the next lull in firing, ask permission to realine them. Likewise, the chief of section promptly reports other unusual incidents that affect the service of the piece.

28. Records Basic Data

The chief of section will record data of a semi-permanent nature in a notebook. These data include minimum elevations; aiming points used and their deflections; prearranged fires when section data sheets are not furnished; safety limits in elevation and deflection; date, hour, and number of rounds fired; and calibration and special corrections when appropriate.

29. Lays the Piece for Elevation When Gunner's Quadrant Is Used

a. Although the normal method of laying for elevation is by use of the elevation counter, the gunner's quadrant may be used to lay for elevation when a refinement greater than 1 mil is desired. The gunner's quadrant is also used to check the accuracy of the elevation counters. The command is QUADRANT (so much), USE GUNNER'S QUADRANT.

b. An elevation of quadrant 361.8, for example, is set on the gunner's quadrant as follows: The upper edge of the plunger plate is set opposite the 360 mark on the scale on the quadrant frame, and the micrometer on the arm is set to read 1.8. Care must be taken to use the same side of the quadrant in setting both the plunger plate and the micrometer.

c. When the announced elevation has been set on the gunner's quadrant, the piece has been loaded, and the breechblock has been closed, the gunner's quadrant is set on the leveling plates of the breech ring. The words *line of fire* must be at the bottom of the quadrant with the arrow pointing toward the muzzle. The chief of section must be sure to use the arrow which appears on the same side of the quadrant as the scale which he is using. He stands squarely opposite the side of the quadrant and holds it firmly on the leveling plates parallel to the axis of the bore. *It is important that he take the same position and hold the quadrant in the same manner for each subsequent*

setting, so that in each case he will view the quadrant bubble from the same angle.

d. The chief of section then directs the assistant gunner to elevate or depress the tube until the bubble is centered, being careful that the last motion is in the direction in which it is more difficult to turn the handwheel of the manual elevating mechanism. The chief of section cautions the assistant gunner when the bubble approaches the center, so that the final centering may be performed accurately.

e. Normally, special and calibration corrections are added algebraically at the battery fire direction center, and the quadrant then would be announced as Number (so-and-so), quadrant (so much).

30. Measures the Elevation

At the command MEASURE THE ELEVATION—the piece having been laid—the chief of section directs the assistant gunner to check the leveling of the elevation quadrant mount. The chief of section then sets the micrometer of the gunner's quadrant at zero and places it on the leveling plates of the breech ring. He then—

a. Moves the plunger arm of the gunner's quadrant until the bubble passes to the end of the vial away from the plunger arm hinge.

b. Slowly lowers the plunger arm until the bubble just passes to the end of the vial toward the hinge.

c. Turns the micrometer until the bubble is accurately centered.

d. Removes the quadrant and reports the elevation setting to the nearest 0.1 mil as "Sir, number (so-and-so), elevation (so much)."

31. Conducts Prearranged Fires

When the execution of prearranged fires is ordered, the chief of section conducts the fire of his section in conformity with the prescribed data.

32. Observes and Checks Functioning of the Materiel

The chief of section closely observes the functioning of all parts of the materiel during firing. Before the piece is fired, he insures that the recoil and counterrecoil systems contain the proper amount of oil; thereafter he carefully observes the functioning of these systems. He promptly reports to the executive any evidence of malfunctioning (TM 9–2300–216–10).

33. Assigns Duties When Firing With Reduced Personnel

When the number of personnel serving the piece is temporarily reduced below that indicated in this manual, the chief of section will assign duties to best facilitate the service of the piece. Loss of cadremen, various details, and casualties will necessitate the section's operating with a reduced number of personnel to the extent that it is almost normal for section members to double up on duties. Around-the-clock firing will require the chief of section to divide the section into shifts to provide for relief.

34. Verifies the Adjustment of the Sighting and Fire Control Equipment

See TM 9–2300–216–10 for detailed instructions on testing and adjusting sighting and fire control equipment.

35. Controls the Movement of the Motor Carriage

When it is necessary to move the motor carriage, the chief of section instructs the driver to start the engine. He then controls the displacement of the motor carriage by hand signals or by oral instructions. To shift the carriage when a new direction of fire is designated, the motor carriage should be moved so that when the tube is pointed in the new direction and the spade is seated the panoramic telescope will be over its original position and the aiming posts will still be in alinement.

36. Checks, Before It Is Restored for Traveling, All Ammunition Not Fired That Has Been Prepared for Firing

The chief of section personally checks all ammunition not fired that has been prepared for firing before it is replaced in containers. He sees that powder increments prepared for firing are present in proper condition, are of the same lot number as the container, and are assembled in proper numerical order. He checks all time fuzes that have been set to see that they are reset to SAFE and that the eyebolt lifting plugs are reinstalled. The chief of section also insures that

grommets are replaced on the rotating bands of projectiles.

Section III. DUTIES OF GUNNER

37. List of Duties

Paragraphs 38 through 46 contain description of duties.

38. Centers the Cross-Level Bubble on the Panoramic Telescope Mount

The gunner centers the cross-level bubble on the telescope mount, as part of all operations that involve the use of the panoramic telescope. This bubble is centered prior to using the telescope and the level of the mount is verified before the gunner calls "Ready." The panoramic telescope M116 and telescope mount T186 are shown in figure 10.

39. Lays the Piece for Direction

The piece being in position, tube in the center of traverse—and not laid for direction, the executive commands Number (SO–AND–SO) ADJUST AIMING POINT THIS INSTRUMENT. After the gunner has reported "Sir, number (so-and-so) aiming point identified," the executive commands number (SO–AND–SO) DEFLECTION (SO MUCH). The gunner opens the door of the azimuth counter and sets the commanded deflection on the azimuth counter dial. He then directs the driver to move the motor carriage until the vertical crosshair of the sight reticle is approximately on the executive's aiming circle. The gunner then traverses the tube until the ver-

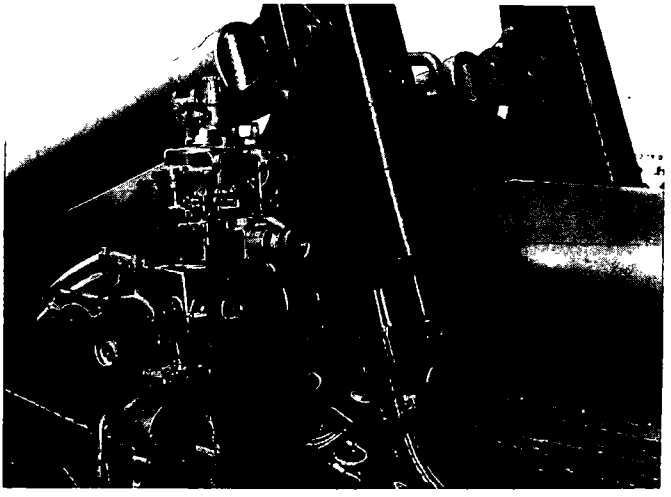


Figure 10. Panoramic telescope M116 and telescope mount T186.

tical crosshair of the telescope is exactly centered on the executive's aiming circle. He checks to insure that the bubbles are level and announces "Sir, number (so-and-so) ready for recheck." As additional deflections are announced by the executive, the gunner sets them on the azimuth counter dial and traverses the tube so that the vertical crosshair of the telescope is centered on the aiming circle. When the executive announces "number (so-and-so) is laid," the tube has been oriented and should not be traversed except on order of the executive. The gunner records the deflection that has been set on the azimuth counter dial and closes the door of the azimuth counter.

40. Alines the Aiming Posts, Assisted by Number 6

The piece having been laid as in paragraph 39, the gunner rotates the head of the panoramic telescope to the left front of the piece and, using hand signals, directs No. 6 in alining the aiming posts with the vertical crosshair of the telescope. If, because of the nature of the terrain, the aiming posts cannot be set to the left front of the piece, they may be set to the left rear. After the aiming posts have been alined, the gunner turns the reset knob, setting 3200 on the azimuth reset counter dial. All subsequent deflections are read from the azimuth reset counter dial.

41. Lays the Piece for Elevation When Directed To Do So by the Chief of Section

The piece is normally laid for elevation by the assistant gunner. However, when circumstances make it desirable for the gunner to lay for elevation, he may do so by using the elevation counter which is a part of the telescope mount and operating the power elevating mechanism. To lay for elevation, the gunner sets the announced quadrant on the elevation counter dial and elevates or depresses the tube using the power elevating mechanism until the elevation level bubble is centered. He must also insure that the cross-level bubble is centered.

42. Sets a Common Deflection to a Common Aiming Point After the Piece Has Been Laid

The piece having been laid, the executive may command AIMING POINT, CHURCH STEEPLE

(or other point), REFER. At this command, without moving the tube, the gunner turns the telescope to the aiming point and reports the deflection indicated on the azimuth reset counter dial. The executive then commands COMMON DEFLECTION 3200. At this command, the gunner depresses the azimuth counter reset knob and sets 3200 on the azimuth reset counter dial. He then makes a final check to verify that the line of sight is still on the aiming point.

43. Sets or Changes the Deflection

The command is DEFLECTION (SO MUCH). If, for example, the command is DEFLECTION 3283, the gunner rotates the azimuth knob in the appropriate direction until 3283 is set on the azimuth reset counter dial. The gunner then traverses the piece until the vertical cross hair of the reticle is on the left edge of the aiming posts or on a designated aiming point. Final motion for traversing is normally accomplished using the manual traversing handcrank and is always from left to right.

44. Signals and/or Calls "Ready"

After the piece has been loaded, primed, and laid in both direction and elevation and is ready to be fired, the gunner calls and/or signals "Ready," by shouting or raising his left arm to signify that the piece is ready to be fired.

45. Refers the Panoramic Telescope

The command is AIMING POINT THIS INSTRUMENT (OR OTHER POINT), REFER.

Without disturbing the laying of the piece, the gunner turns the panoramic telescope until, with the elevation and cross-level bubbles centered, the vertical crosshair of the reticle is on the point designated. He then opens the door of the azimuth counter dial, reads the deflection on the azimuth counter and reports to the executive, "Sir, number (so-and-so) deflection (so much)."

46. Makes Corrections for Aiming Post Displacement

For details of correcting for aiming post displacement, see paragraph 111.

Section IV. DUTIES OF ASSISTANT GUNNER, CANNONEERS, AND DRIVER

47. Assistant Gunner's Duties

Paragraphs 48 through 51 contain description of duties.

48. Sets Announced Elevation

The assistant gunner sets the elevation announced by the executive on the elevation quadrant dial (fig. 11), using the elevation knob.

49. Lays for Elevation

Having set the announced elevation on the elevation quadrant, the assistant gunner elevates or depresses the tube, using the power and manual elevating mechanisms, until the elevation level bubble is centered, and insures that the cross-level bubble is also centered. Final adjustment is made manually in the direction of increasing resistance.

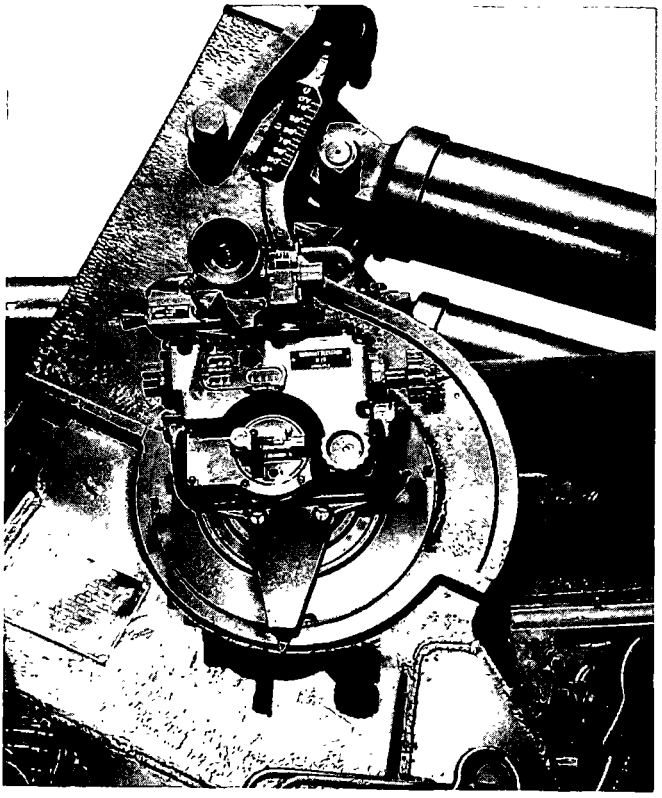


Figure 11. Elevation quadrant M15.

50. Calls "Set" When the Piece Has Been Laid for Elevation

When the tube has been laid at the announced elevation and the bubbles in the elevation level and cross-level vials have been centered, the assistant gunner calls "Set."

51. Returns the Tube to Loading Elevation After Firing

After the piece has been fired, the assistant gunner returns the tube to the loading elevation (180 mils) which is marked by an index on either trunnion bearing.

52. List of Number 1 Cannoneer's Duties

Paragraphs 53 through 56 contain description of duties.

53. Loads and Rams the Projectile

The loader-rammer being in the stowed position, No. 1 operates the swing control (fig. 12) to move the loader-rammer to the rear of the piece. He then operates the loader control to lower the loader arms to receive the loading tray and projectile. Assisted by No. 2, No. 1 then moves the loading trough forward to the breech ring. When the loading tray has been attached to the loading arms by Nos. 3 and 4, No. 1 again operates the loader control to raise the loading tray and projectile to the loading trough. He then operates the ram control to ram the projectile.

54. Receives and Loads the Powder Charge

Having rammed the projectile, No. 1 turns and receives the powder charge from Nos. 7 and 8 and lays it on the loading trough assisted by No. 2. No. 1 then moves the powder charge forward into the chamber.

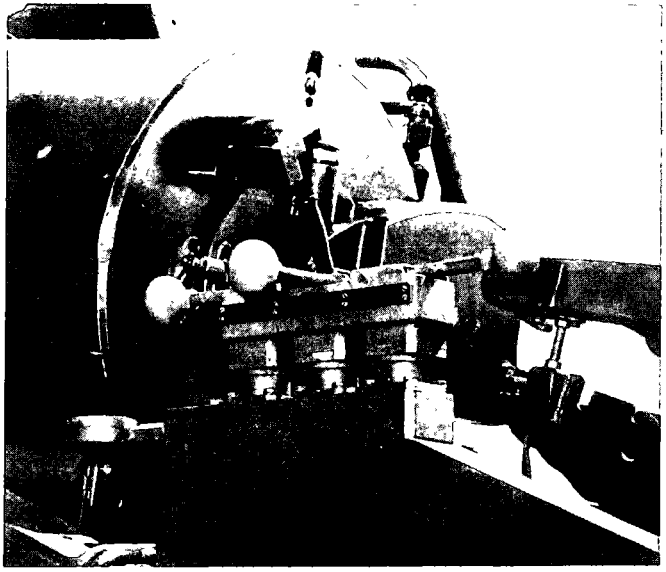


Figure 12. Loader and rammer controls.

55. Stows the Loader-Rammer

After the projectile and powder charge have been loaded, No. 2 removes the loading tray from the loading trough and No. 1 operates the swing control to move the loader rammer to the stowed position.

56. Inserts the Primer and Closes the Firing Lock

After the breech has been closed, No. 1 inserts a primer into the firing lock and turns the firing lock handle in a counterclockwise direction.

57. List of Number 2 Cannoneer's Duties

Paragraphs 58 through 61 contain description of duties.

58. Assists Number 1 in Loading the Projectile and Powder Charge and Removes the Loading Tray

After No. 1 has placed the projectile on the loading trough, No. 2 grasps the handle of the loading trough and assists in moving the loading trough forward to the breech ring. After No. 1 has received the powder charge from Nos. 7 and 8, No. 2 assists No. 1 in loading the powder charge on the loading trough. After the powder charge has been loaded, No. 2 assists No. 1 in moving the loading trough to the rear, removes the loading tray from the loading trough and passes it to No. 3.

59. Opens and Closes the Breech

After the projectile and powder have been loaded and the loader-rammer has been moved to the stowed position, No. 2 closes the breech. After the piece has been fired, No. 2 opens the breech.

60. Attaches the Firing Lanyard and Fires the Piece

After No. 1 has inserted the primer, No. 2 attaches the lanyard to the firing lock and at the signal or command of the chief of section, he pulls the lanyard with his right hand in a quick steady movement to the left rear. Immediately after firing, No. 2 detaches the lanyard. In case of a misfire, the instructions contained in paragraph 174 will be followed.

61. Checks To Insure That the Spent Primer Has Been Ejected, Swabs the Powder Chamber, and Inspects the Bore

After the piece is fired, No. 2 opens the breech and the spent primer is ejected automatically. No. 2 checks as he opens the breech to insure that the primer has been ejected. He then swabs the powder chamber, inspects the bore for obstructions and, if clear, he announces "Bore clear."

62. List of Number 3 and Number 4 Cannoneers' Duties

Paragraphs 63 through 66 contain description of duties.

63. Install the Projectile on the Loading Tray

After the projectile has been fuzed and prepared for firing, Nos. 3 and 4 place it on the loading tray and strap it to the tray.

64. Carry the Projectile to the Loader-Rammer and Attach the Loading Tray to the Loading Arms

After the projectile has been loaded on the loading tray, No. 3 grasps the loading tray on the left side and No. 4 grasps the tray on the right side. Together they carry the loading tray to the rear of the piece and attach it to the loading arms of the loader-rammer.

65. Receive the Loading Tray From Number 2 After Loading

After the projectile and the powder charge have been loaded, No. 2 removes the loading tray

from the loading trough and passes it to No. 3, who returns it to the ammunition point.

66. Assist in Preparing Ammunition

Numbers 3 and 4 assist in preparing ammunition and perform other duties as directed by the chief of section.

67. List of Number 5 Cannoneer's Duties

Paragraphs 68 through 72 contain description of duties.

68. Fuzes or Changes Fuzes of Projectiles

Number 5 unscrews the eyebolt lifting plug from the fuze socket of the projectile; inspects the socket for rust and dirt; removes (or replaces) the supplementary charge, if necessary; and screws in the designated fuze. In tightening or loosening the fuze of the projectile, only the authorized fuze wrench should be used. Variable time (VT) fuzes should be screwed in by hand and tightened with fuze wrench M18 by using manual force only. *Do not hammer on the wrench or use an extension handle.* If a time fuze is used, No. 5 removes the safety pull wire from the fuze and, if a booster is present, removes the safety pin from the booster. Boosters without safety pins must not be used.

69. Sets the Fuze Setter M26 or M28

Number 5 releases the time scale clamping screw marked "T" and, grasping the handle, turns the body until the index on the body is opposite the announced time on the time scale. He

then locks the time scale clamping screw, being careful not to disturb the setting. For accuracy, he looks squarely at the scales and indexes in the same manner each time.

70. Sets Fuzes

a. Selective Superquick and Delay Fuze. When FUZE QUICK is announced, No. 5 will verify the superquick setting. (The slot on the setting sleeve should be alined with the letters SQ.) When FUZE DELAY is announced, No. 5 will turn the setting sleeve with a fuze wrench, screwdriver, or similar tool until the slot is alined with the word DELAY.

b. Combination Time and Superquick Fuze. The combination time and superquick fuze may be set for time action. However, the percussion element will detonate the round upon impact if the time element fails. After fuzing the projectile, No. 5 removes the safety pull wire from the fuze. For percussion action, the command is FUZE M55 (or M500, M520, etc.) QUICK. No. 5 then verifies that the S on the setting ring is alined with the index on the fixed ring; if not, he sets it at S.

c. Time Fuzes.

(1) *Using Fuze Setter M26 or M28.* After making the announced settings on the fuze setter, No. 5 removes the safety pull wire from the fuze, carefully places the fuze setter over the fuze, and turns the setter in the direction of increasing readings until the notch on the time ring

of the fuze engages the stop on the setting ring of the fuze setter. He places the handle in the most convenient position, pushes down the fuze setter until the notch fully engages the stop, and continues to turn it in the direction of increasing readings until the pawl in the adjusting ring assembly drops into the notch of the fixed fuze ring. This action prevents further turning and indicates that the fuze is set. He then lifts the fuze setter from the fuze without rotating it and makes a visual check of the fuze setting to insure that the fuze ring notch was actually engaged and that the fuze is properly set. Once set, if the time setting on the fuze is to be changed, the fuze setter is reset to the desired time setting, and the fuze is set again as described above.

(2) *Fuze setter M14 or M27.* Fuze setter M14 or M27 is a wrench-type fuze setter in which the fuze time scale is used in setting the fuze. After the safety pull wire has been removed, No. 5 places the fuze setter on the fuze with the taper contour of the hole fitting the fuze. He engages the key in the wrench with the slot on the fuze and turns the wrench in the direction of increasing readings until the index mark on the fuze alines with the required time setting on the fuze scale. No. 5 then removes the

wrench, being careful to avoid changing the setting, and visually checks the fuze to insure that it is properly set.

d. VT Fuzes. The older type VT fuzes (M97) operate and function in such a manner as to require no setting by personnel. The new type VT fuzes (M514-series) have a time setting ring and are set by using the fuze setter M28 in the same manner as the M54-series time fuzes are set by using the fuze setter M26. However, if the fuze setter M28 is not available, the wrench type fuze setter is used to set the new type VT fuzes. VT fuzes of certain lots are issued with a wax coating on the plastic ogive. This wax coating is necessary for the proper functioning of the fuze and should not be removed. VT fuzes should be used as issued; that is, with the wax coating on the ogive, if so issued, or without a wax coating, if so issued.

71. Removes Fuzes From Projectiles

If a projectile that has been fuzed is not to be fired, the fuze is removed. The operation of inserting a fuze is reversed. Supplementary charges are replaced, if they were issued with the projectile. The booster cotter pin of the fuze is replaced if a booster is used. Combination superquick and delay fuzes are reset to SQ (superquick). Time fuzes are reset to S (safe) and the safety pull wire is replaced. M514-series VT fuzes are reset to initial setting as shipped; i.e., to S or 0 (depending on the model number). All fuzes are returned to their containers. The eyebolt lifting

plugs are replaced in the fuze sockets of the projectiles.

72. Assists in Preparing Ammunition

In addition to fuzing ammunition No. 5 assists in uncrating and preparing ammunition for firing and performs other duties as directed by the chief of section.

73. List of Number 6 Cannoneer's Duties

Paragraphs 74 through 76 contain description of duties.

74. Sets Out Aiming Posts

No. 6 sets out aiming posts as described in paragraph 110.

75. Assists Number 5 in Fuzing Projectiles

No. 6 assists No. 5 in performing the duties prescribed in paragraphs 68 through 72 above.

76. Assists in Preparing Ammunition

No. 6 assists in preparing and uncrating ammunition and performs other duties as directed by the chief of section.

77. List of Number 7 Cannoneer's Duties

Paragraphs 78 through 80 contain detailed description of duties.

78. Prepares Powder Charges

a. The propelling charge for the 175-mm gun is composed of a base charge and two increments. The base charge is charge one, the base charge

plus the first increment is charge 2, and the base charge plus both increments is charge 3. The rear end of the base charge contains an igniter pad which is usually dyed a red color. A cup shaped, felt based cloth cover fastened to the charge by a drawstring protects the igniter pad and is removed just before loading. Three tying straps are sewed to the front end of the base section and serve to assemble the base charge and increments into one propelling charge. When the command designating the charge is given—for example, CHARGE 2, No. 7, assisted by No. 8, takes a complete charge from a container, places the complete charge in front of him with the base charge on the bottom and unties the straps which hold the bags together. He removes the increment charge from the top and loosely and uniformly reties the straps. No. 7 then removes the igniter protector cap and the ammunition data tags. Unused increments are disposed of as directed by the battery executive. In night firing when the flash reducer M1 is to be used, No. 7 will tie the flash reducer around the propelling charge as described in TM 9–1300–203.

Caution: **Containers should not be opened until just before the charges are to be used.**

b. Two propelling charges are available for the 8-inch howitzer. These are charge, propelling, M1 (green bag) and charge, propelling, M2 (white bag). *Under no circumstances will sections of the green bag charge be mixed with sections of the white bag charge (TM 9–1901), and powder containers should not be opened until just before the*

charges are to be used. The propelling charge M1 is composed of a base charge and four unequal increments corresponding to the first five zones of fire. As in *a* above, this charge contains an igniter pad, an igniter pad protector, and four tying straps which must be untied to decrease the charges used in firing and retied. The base charge is charge 1, and the other charges are numbered from 2 to 5, inclusive. When the command designating the charge is given—for example, CHARGE 4, No. 7 assisted by the driver, when available, takes a complete charge from a container, places it in front of him with the base charge on the bottom and unties the straps which hold the bags together. He removes the bag marked "5" from the top, leaving the bag marked "4" on the top of the pile, and checks all charges to ascertain their presence in the proper order. He then loosely and uniformly reties the straps and removes the cloth igniter pad protective cover. As this propelling charge is considered flashless under all conditions, no flash reducer is provided. Propelling charge M2 (white bag) is composed of a base charge and two increments. The base charge is the equivalent of charge 5. The increments provide charges 6 and 7. The preparation of an M2 charge is similar to preparation of the M1 except that no charge lower than charge 5 can be prepared. In night firing, when the flash reducer M3 (T3) is to be used, No. 7 assembles the propelling charge and inserts the flash reducer at the forward end under the tie straps.

79. Carries the Powder Charge to the Piece Assisted by Number 8

Number 7, assisted by number 8, carries the powder charge to left rear of the piece. No. 7 is on the left side of the powder charge and No. 8 is on the right, with the igniter pad to the front of the piece.

80. Passes the Powder Charge to Number 1 and Calls Out the Number of the Charge

After the projectile has been rammed by No. 1 and he has turned to receive the powder charge, No. 7 passes the powder charge to No. 1 and calls out the number of the charge that he has prepared; for example, "Charge 3." This informs the chief of section that the proper charge has been prepared.

81. List of Number and Cannoneer's Duties

Paragraphs 82 through 84 contain description of duties.

82. Assists No. 7 in Preparing Powder Charges

Number 8 assists Number 7 in his duties in preparing powder charges as prescribed in paragraph 78.

83. Assists Number 7 in Carrying the Powder Charge to the Piece

Number 8 assists Number 7 in carrying the powder charge to the piece as prescribed in paragraph 79.

84. Performs Other Duties Prescribed by the Chief of Section

Number 8 will assist in unloading powder charges and ammunition and perform such other duties as prescribed by the chief of section.

85. List of Prime Mover Driver's Duties

Paragraphs 86 through 88 contain description of duties.

86. Assists in Preparing Powder Charges

The prime mover driver assists in unloading powder charges and ammunition, assists Nos. 7 and 8 in preparing powder charges as prescribed in paragraph 78, and performs such other duties as are prescribed by the chief of section.

87. Shifts the Motor Carriage

When directed to do so by the chief of section, the prime mover driver shifts the motor carriage under the direction of the gunner as prescribed in paragraph 39.

88. Performs Maintenance in Stabilized Positions

When the situation is stabilized, the driver performs such preventive maintenance as may be accomplished without interfering with the firing of the piece. Any disassembly or maintenance operation that will render the vehicle immobile for any period of time must be ordered by the chief of section.

CHAPTER 6

FIRING BY DIRECT LAYING

Section I. TECHNIQUE OF FIRE

89. General

a. Firing by direct laying is a special technique that requires a high standard of training. The section must operate as an independent unit. Training in direct laying is based on the technique involved in indirect laying. Targets taken under fire in direct laying are usually those capable of returning fire at pointblank range; therefore, the speed and accuracy required in indirect laying become even more important for direct laying missions.

b. The *two-man, two-sight* system is normally used in laying for the attack of a mobile target. However, if the piece is not equipped with an elbow telescope; the *two-man two-sight system* must be modified by using the elevation quadrant to lay for elevation. This system is referred to as the *two-man, one-sight* system. In either case, the gunner continues to lay for direction by viewing the target through the panoramic telescope. When the *one-man, one-sight* system is used, the gunner lays for lead and elevation with the pan-

oramic telescope and the elevation counter of the telescope mount.

c. Stationary point targets, such as embrasures in permanent fortifications or cave openings, may be attacked by using either the indirect or direct laying methods. The indirect method is preferable. When the direct laying method is employed in attacking targets of this type, the service of the howitzer is as prescribed in *b* above.

d. For additional information on direct laying, see FM 6–40 and FM 6–140.

90. Preparation of a Range Card

a. The chief of section is responsible for defense in his assigned sector, but he should be prepared to fire on targets in other sectors.

b. As soon as possible after occupation of position, the chief of section measures or estimates the ranges to critical points in likely avenues of approach for enemy tanks and vehicles and prepares a range card (fig. 13) on which he notes the ranges and elevations for quick references.

c. If there are no prominent terrain features, stakes may be driven into the ground at critical points for reference. As time permits, the range card is improved by replacing estimated ranges with more accurate ranges obtained by firing, pacing, taping, vehicle speedometer reading, map measurement, or survey.

91. Field of Fire

The sector of fire for the section should be cleared of all obstructions that might endanger

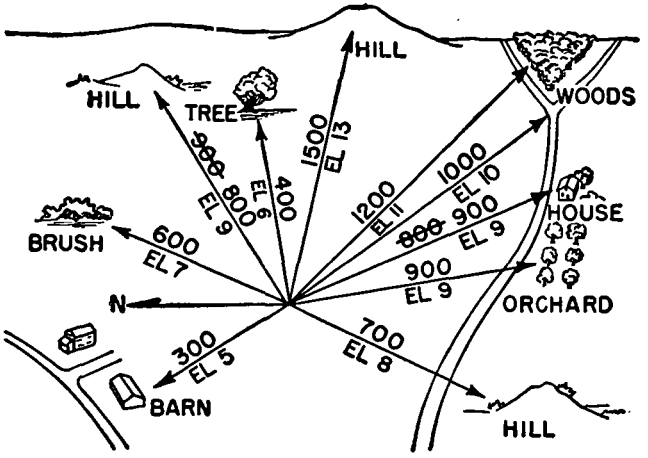


Figure 13. Range card for direct laying.

battery personnel when the piece is fired or that might hinder observation. Care should be taken not to reveal the location of the position.

92. Targets

Targets for direct laying usually consist of vehicles, tanks, and personnel threatening the battery. Enemy personnel, whether alone or accompanying tanks, will seldom present themselves as a clearly defined target. Normally, attacking troops, using all available cover, reveal themselves only fleetingly. Accordingly, fire is conducted on the area containing the attackers rather than on the individuals. Tanks usually attack in groups and may be accompanied by infantry. Normally, first priority is given to attack of those targets within the assigned sector of the weapon

and second priority to targets in other sectors. Priority within the assigned zone is given to—

a. Tanks at short ranges, threatening to overrun the position.

b. Hull-down, stationary tanks covering the advance of other tanks.

c. The commander's tank, if identified.

d. The tank nearest cover, which may disappear and reappear at unexpected places.

e. The rear tank of a column moving across the front of the position, to minimize the possibility of attracting attention of the tank column to the battery position.

93. Ammunition and Fuzes

a. General. For close-in fires, a variety of fuzes are available (TM 9-1300-205). For high-explosive shell, the highest charge is used habitually for speed, ease in adjustment, imparting forward motion to fragments, and more effective fuze action. The flat trajectory resulting from the use of the highest charge coupled with dug-in guns may make extremely close-in firing impossible, since the projectiles may not detonate on impact. At ranges of 200 to 400 meters, fuzes may fail to function on hard, flat ground. However, preparation of sectors of fire will remedy this situation. The terrain may be prepared for direct fire by placing mounds of sandbanks, dirt, or logs in the sector of responsibility. When direct fire is placed on these points or other previously selected points, as they are approached by an attacking force, the necessity for adjusting fire is reduced.

b. Ammunition. Only high-explosive (HE) ammunition is used. Shell, HE, is ideally suited for antipersonnel fire and is effective against vehicles and tanks.

c. Fuzes. High explosive shells may be fuzed with fuzes quick, delay, time, concrete piercing, or variable time. Fuze quick is the most desirable fuze to use with HE shells for close-in fires. It is highly effective and, since no fuze setting is required, is much faster to use. The time required to set the fuze and to adjust the point of impact for maximum ricochet effect makes fuze delay less desirable than fuze quick. If fuze delay is used for ricochet effect, the point of impact is adjusted 10 to 30 meters short of the target; if less than 50 percent of the bursts ricochet, fuze quick should be used. Fuze time is the least desirable type of fuze for close-in fires. Because of the wide range dispersion resulting from variations in time of burning with short fuze settings, fuze time should be used only for ranges greater than 1,000 meters. The area covered effectively by air and ricochet bursts are similar. Concrete piercing fuze with shell HE should be used against concrete pillboxes or fortifications.

94. Trajectories

Trajectory characteristics change with the type of ammunition and the charge fired. Since firing tables for the 175-mm gun are classified CONFIDENTIAL, trajectory characteristics for the 175-mm gun are not discussed in this unclassified manual. For information concerning trajectory

for the 175-mm gun, refer to the firing tables. The following trajectory characteristics govern conduct of fire for the 8-inch howitzer when the highest charge is used.

a. Ranges from 0 to 500 meters. Within these range limits, the trajectory will be flat enough to prevent an 8-foot tank from passing safely under it. Fields of fire and terrain allowing the upper range limits for the ammunition and charge used are the ideal at which to open fire. Fire can then be conducted over the maximum time without misses, if deflection is correct. Also, there is less risk of obscuring the target with the smoke from a short burst.

b. Ranges for 600 to 1,400 meters. These range limits include the zone in which the trajectory is sufficiently flat to permit direct estimation of range without actually bracketing the target. If there is little dispersion and a round fired at the upper range limit hits the bottom of an 8-foot tank, adding of a 100-meter range change will result in a round which will just brush the top of the tank. During adjustment within this zone, range changes should seldom be more than 100 meters and range changes of 50 meters will frequently be sufficient. The upper limits mentioned herein are the greatest ranges at which fire should be opened unless tactical conditions require otherwise. A trained howitzer crew should obtain a hit with the second shot.

c. Ranges from 1,600 to 2,300 meters. This zone includes the ranges at which hits are only reasonably possible. A bracket is normally estab-

lished to obtain adjustment in this zone. Since there is more dispersion in this zone, fire should not be opened at these ranges unless surprise is not important. Indirect fire will usually give better results at these ranges against stationary targets or slow moving targets such as infantry.

d. Ranges over 2,300 meters. At these ranges, direct laying is not advisable against moving targets. Dispersion is the controlling factor. Ranges must be known or determined by bracketing. At these ranges, the slope of fall of the projectile becomes so great that a hit on a moving target is very difficult to obtain.

95. Vertical Displacement Tables

Vertical displacement is the change in the point of burst (up or down) between two rounds fired with different ranges at an upright target. The vertical displacements for a 100-meter range change at various ranges are shown in table IV for the 8-inch howitzer.

Section II. DUTIES OF CHIEF OF SECTION

96. List of Duties

Paragraphs 97 through 103 contain description of duties.

97. Conducts the Fire of His Piece

The chief of section conducts the fire of his piece when the executive commands TARGET (so-and-so), FIRE AT WILL, or simply FIRE AT WILL.

Table IV. Vertical Displacement per 100-Meter Range Change, 8-Inch Howitzer M110.

Range (yards)	Range (meters)	Displacement feet, shell HE, M106, charge 7	Remarks
100	100	.0	Start firing using 400-meter range setting.
200	200	1.0	
300	300	1.5	
400	400	2.0	Start firing with estimated range.
500	500	2.5	
600	500	3.0	Increase or decrease by multiple of 50 or 100 meters.
700	600	3.5	
800	700	4.0	
900	800	4.0	Bracketing not necessary.
1,000	900	4.5	
1,100	1,000	5.0	
1,200	1,100	5.5	
1,300	1,200	6.0	
1,400	1,300	6.5	
1,500	1,400	7.0	
1,600	1,400	7.5	Bracket target (get bursts over and short) to obtain hit.
1,700	1,500	8.0	
1,800	1,600	8.5	
1,900	1,700	9.0	
2,000	1,800	9.5	
2,100	1,900	10.0	
2,200	2,000	10.5	
2,300	2,100	11.5	
2,400	2,200	12.0	
2,500	2,300	12.5	At ranges over 2,300 meters using shell HE, charge 7, direct laying is too inaccurate to be used against moving targets.

98. Identifies or Selects the Target

If the executive designates an object or one of a group of objects as the target, the chief of sec-

tion must correctly identify the target. If the target is a group of tanks or other objects, the chief of section selects the one that, in his estimation, is the greatest threat to his own position or the position of the supported troops. He repeats the identification to his section, using the minimum number of words, such as LEAD TANK or MOVING TANK.

99. Estimates the Range to the Target

Range cards (fig. 13) with accurately measured ranges to key points provide the best means for determining the initial range. If a range card has not been prepared, the range is estimated.

100. Conversion of Range to Quadrant

The chief of section will prepare and have available, a table for use in converting range to quadrant. Maximum charge is used preparing the table. An example of such a table is table V. When any method of fire other than the *two-man, two-sight* system is used, the chief of section converts the estimated range to mils and announce this value in his fire command as QUADRANT (so much).

101. Determines the Lead in Mils

The appropriate lead in mils for targets moving at various speeds for firing with the maximum charge is as follows:

Lateral speed	Lead (mils)	
	175-mm gun	8-inch howitzer
Under 10 MPH	5	5
10 MPH or over	5	10

Table V. Direct Fire Table, 8-Inch Howitzer M110 (Quadrant in Mils)

Range		Height of Target above gun-meters					
(yards)	(meters)	0	200	400	600	800	1000
100	100	1	1,129				
200	200	3	803	1,131			
300	300	4	603	949	1,132		
400	400	6	478	806	1,007	1,134	
500	500	7	395	695	900	1,039	1,135
600	500	8	364	651	854	996	1,074
700	600	9	337	608	809	954	1,059
800	700	10	294	540	732	878	989
900	800	12	261	484	668	812	925
1,000	900	13	236	440	613	754	867
1,100	1,000	15	216	403	566	703	815
1,200	1,100	16	200	372	525	657	769
1,300	1,200	18	186	346	491	617	726
1,400	1,300	20	175	324	460	582	688
1,500	1,400	21	166	305	434	551	654
1,600	1,400	22	162	297	422	536	638
1,700	1,500	23	158	289	411	522	623
1,800	1,600	25	151	274	390	497	594
1,900	1,700	26	146	262	372	475	569
2,000	1,800	28	141	251	356	454	545
2,100	1,900	30	137	241	342	436	524
2,200	2,000	31	133	233	329	419	504
2,300	2,100	33	130	225	317	404	487
2,400	2,200	35	127	218	306	391	470
2,500	2,300	37	125	212	297	378	455

102. Gives Initial Commands

The chief of section gives fire commands containing the following elements in sequence:

a. Designation of Target. The command is TARGET (so-and-so). Identification must be

clear and unmistakable and should be expressed in the minimum number of words.

b. Projectile, Charge, and Fuze. The chief of section selects the appropriate projectile, charge, and fuze and commands SHELL (such-and-such), CHARGE (such-and-such), if applicable, and FUZE (such-and-such).

c. Lead. The command is LEAD (so much). See paragraph 101 for the method of determining lead.

d. Method of Fire. Fire is continuous unless otherwise commanded. In continuous fire, the piece is loaded and laid as rapidly as possible and fired at the command of the gunner.

e. Range or Quadrant. The command is RANGE (so much) or QUADRANT (so much). The range commanded by the chief of section is that range to be set on the sight reticle of the direct fire telescope. For determining range, see paragraph 99. If the *two-man, one-sight* system or the *one-man, one-sight* system is to be used, the chief of section announces the range element of the command as quadrant. The announced quadrant is applied as indicated in paragraphs 104 and 105.

103. Gives Subsequent Commands Based on Observed Effect

a. The chief of section gives the following commands based on observed effect:

(1) *Change in lead.* During adjustment, the lead in mils is changed by the command RIGHT (LEFT) (so much).

(2) *Change in range.* During adjustment, the range is increased by the command ADD (so much) and is decreased by the command DROP (so much). When the *two-man, one-sight* system or *one-man, one-sight* system is used, the commands are UP (so much) or DOWN (so much).

b. When the breechblock is closed, the chief of section gives further changes in firing data based on movement of the target during the time required for loading.

Section III. DUTIES OF THE GUNNER, ASSISTANT GUNNER, CANNONEERS, AND DRIVER

104. Two-Man, Two-Sight System

a. Duties of the Gunner. Having received the fire command, the gunner performs the following duties:

(1) The gunner insures that the cross-level bubble is centered, the deflection counter dial is set at zero, and the gunner's aid index is at zero.

(2) The gunner establishes the lead announced by the chief of section by sighting through the panoramic telescope and traversing the tube until the target appears in the proper relationship to the vertical crosshair of the sight reticle (fig. 14). When the announced lead has been established the gunner calls "Set" and continues to track the target by traversing the tube. He continues to call

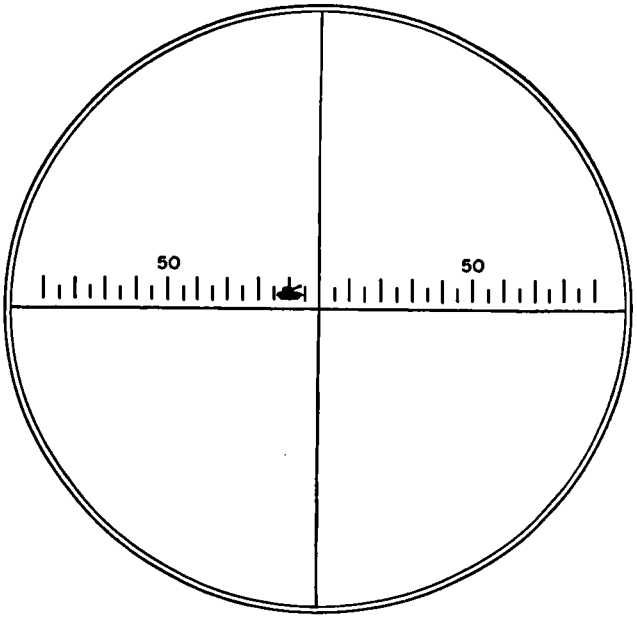


Figure 14. Gunner's sight picture, panoramic telescope, lead 10 mils.

"Set" as long as the proper lead is maintained.

(3) When the assistant gunner calls "Ready," indicating that the tube has been laid for range and when, at the same time, the proper lead has been established, the gunner commands FIRE.

(4) After firing, the gunner continues to track and fire on the target until it is destroyed or until a subsequent fire command is issued by the chief of section.

b. Duties of the Assistant Gunner. Having received the fire command, the assistant gunner performs the following duties:

(1) Insures that cross-level level bubble is centered, the elevation counter dial is set at zero, and the appropriate setting is on the correction indicator dial.

(2) Lays the piece for range (elevation) by sighting through the direct fire telescope and by elevating or depressing the tube until the target appears in the proper relationship to the range lines of the telescope reticle (fig. 15).

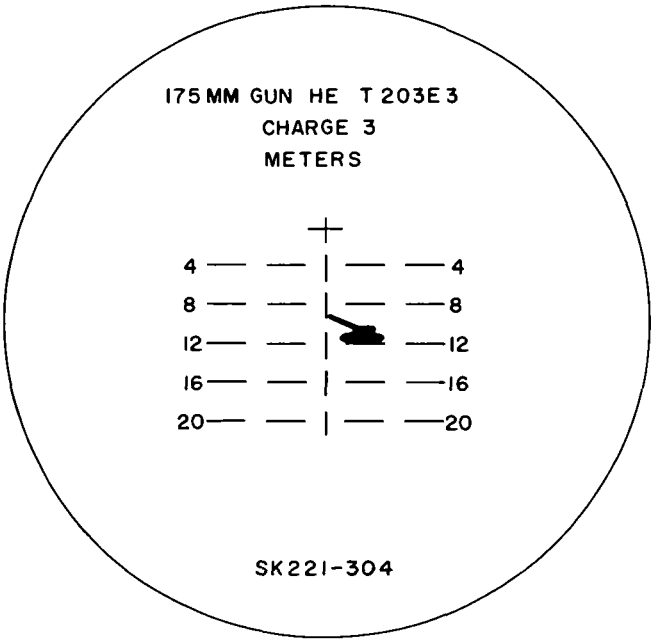


Figure 15. Assistant gunner's sight picture, direct fire telescope, range 1,200 meters, lead 5 mils.

(3) When the piece has been laid for range (elevation), the assistant gunner calls "Ready."

(4) After firing, the assistant gunner continues to lay on the target, until it is destroyed or until a subsequent fire command is issued by the chief of section.

105. Two-Man, One-Sight System

a. Duties of the Gunner. The duties of the gunner in the two-man, one-sight system are the same as those listed in paragraph 104*a* for the *two-man, two-sight* system.

b. Duties of the Assistant Gunner. In the *two-man, one-sight* system, the chief of section announces quadrant rather than range in his fire command. The assistant gunner sets the announced quadrant on the elevation counter dial and insures that the appropriate setting is on the correction indicator dial. He then elevates or depresses the tube until the elevation level bubble is level and centers the cross-level level bubble. When the tube has been laid at the announced quadrant, the assistant gunner calls "Set."

106. One-Man, One-Sight System

a. In the one-man, one-sight system, the piece is laid for both deflection and elevation by the gunner. The chief of section announces quadrant in his fire command rather than range.

b. The gunner sets the announced quadrant on the elevation counter dial and insures that the appropriate setting is on the elevation correction

indicator dial. He then elevates or depresses the tube until the elevation level bubble is centered and centers the cross-level level bubble. With 3200 set on the azimuth counter dial and the gunners aid index at zero, he then traverses the tube until the vertical crosshair of the telescope reticle is on the target or the proper lead is established. When the tube has been laid, the gunner commands FIRE. After firing, he continues to lay on the target until it is destroyed or a subsequent fire command is given by the chief of section.

107. Duties of Cannoneers and Driver

a. Cannoneers perform the same duties in firing by direct laying as, those prescribed for firing by indirect laying. Number 2 receives the command to fire from the gunner.

b. The driver of the motor carriage takes his post in the driver's compartment, starts the engine, and prepares to shift the vehicle as directed.

CHAPTER 7

MISCELLANEOUS PROCEDURES AND TECHNIQUES

108. Precision in Laying

a. Sighting and laying instruments, fuze setters, and elevating and traversing mechanisms must be properly operated to reduce the effects of lost motion. For uniformity and accuracy, the last motion in setting the instruments must be from lower to higher numbers; final motion of the elevating handwheel must be in the direction of more difficult movement, and final motion in traversing must be from left to right. Personnel who lay the piece must be required to verify the laying after the breech has been closed.

b. When a bubble is centered, the line of sight must be at a right angle to the scale or level vial to prevent parallax errors. Bubbles must be centered exactly.

c. For uniformity and accuracy in laying on aiming posts, the vertical crosshair in the reticle of the panoramic telescope must be alined with the left edges of the aiming posts.

109. Aiming Points

a. General. After the piece has been laid initially for direction, it is referred to the aiming

posts and usually to one or more distant aiming points as described in paragraph 42. An aiming point must have a sharply defined point or vertical line which is clearly visible from the piece, so that the crosshairs of the panoramic telescope can be alined on exactly the same place each time the piece is relaid.

b. Distant Aiming Point. A distant aiming point is one at sufficient distance so that normal displacements of the piece in firing or traverse will not cause a horizontal angular change in direction (with the same settings on the azimuth counters) of more than one-half mil. This distance should be at least 3,000 meters. The executive officer usually designates the distant aiming point or points to be used.

110. Aiming Posts

a. Two aiming posts are used for each piece. Each aiming post is equipped with a light for use at night. The most desirable distance from the piece to the far aiming post is 100 meters, considering accuracy of laying, visibility, and ability to control the aiming post lights. First, the far aiming post is set up and alined. The near aiming post is then set up at the midpoint between the far aiming post and the panoramic telescope and is alined by the gunner so that the vertical crosshair of the telescope and the left edge of the two aiming posts are in alinement. To insure equal spacing of aiming posts, the distances to both the near and far aiming posts should be paced by the same man. If ground conditions make pacing in-

accurate, the distances from the piece to the aiming posts may be measured by using the panoramic telescope, with the aiming posts as measuring devices (*d* below).

b. For night use, the aiming post lights should be adjusted so that the far light will appear several feet above the near light. On flat terrain this may be accomplished by using only the lower half of the near aiming post. The two lights placed in this way will establish a vertical line for laying the piece.

c. Since the panoramic telescope is mounted at considerable distance from the center of rotation of the top carriage, large changes in deflection will cause misalinement of the aiming posts. Placing the aiming posts to the left front when the piece is in the center of traverse will keep this misalinement to a minimum and still allow maximum visibility.

d. To measure the distance from the piece to the aiming posts, the stadia method may be employed by using the panoramic telescope and the aiming posts as measuring devices. Number 6 cannoneer, in setting out the aiming posts, holds the upper section of one of the aiming posts in a horizontal position, perpendicular to the line of sighting. The gunner measures the length of this section in mils using the reticle of the panoramic telescope. For example the upper section of the aiming post is 4½ feet long and measures 14 mils when it is 100 meters from the piece. The proper location for the near aiming post, in this case, would be the point at which the 4½-foot section

measures 28 mils. In many cases, the ideal spacing of 50 and 100 meters cannot be obtained, but the aiming posts will be properly spaced when the near aiming post is set at a point where the 4½-foot section measures twice the number of mils it measured at the far aiming post location. This measurement may be performed at night by attaching the night lighting devices at the 4½-foot marks on the aiming posts.

111. Correction for Displacement of Aiming Posts

When the gunner notes that the vertical line of the telescope is displaced from the line formed by the two aiming posts (or aiming post lights), he lays the piece so that the far aiming post (light) appears exactly midway between the near aiming post (light) and the vertical crosshair (fig. 16). If the displacement is due to traversing the piece, the gunner continues to lay as described above. If the displacement is due to progressive shifting of the carriage caused by the shock of firing, or other cause, the gunner will notify the chief of section, who, at the first lull in firing, will notify the executive and request permission to realine the aiming posts. To realine the aiming posts, the piece is laid with the far aiming post midway between the near aiming post and the vertical crosshair (fig. 16). The far aiming post is moved into alinement with the vertical crosshair of the telescope and then the near aiming post is alined. If terrain conditions make it impracticable to move one of the two aiming posts, the piece is laid for direction and re-

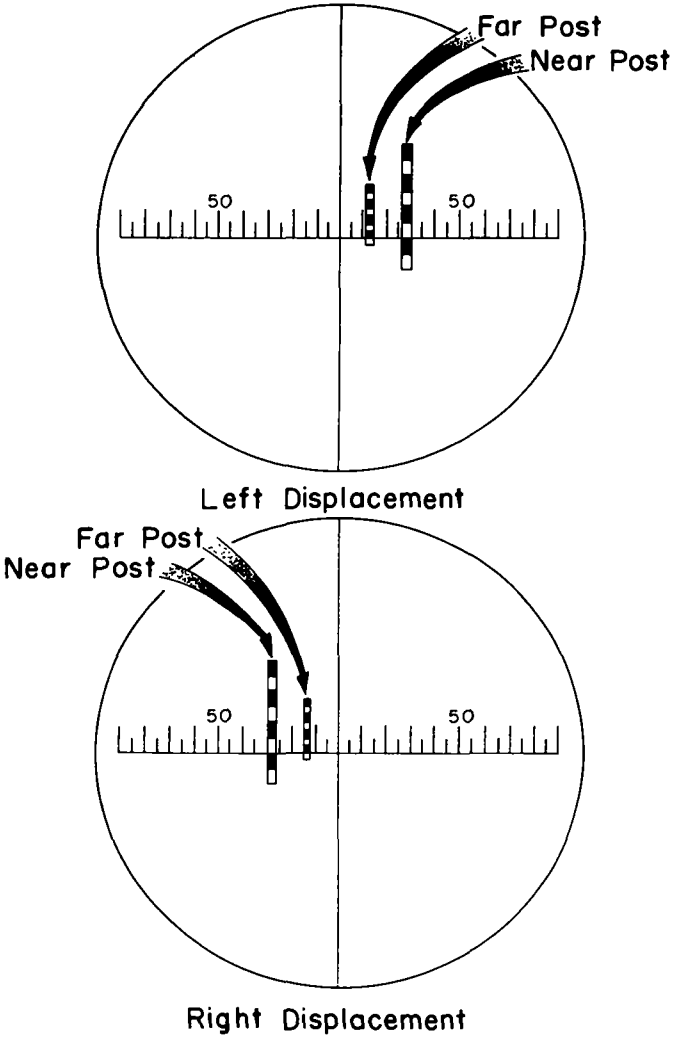


Figure 16. Gunner's sight picture of aiming posts in proper relationship when correcting for displacement.

ferred to the aiming post that cannot be moved. The other post is alined by using the method described in paragraph 40, and the azimuth reset counter is turned to 3200.

112. Testing Targets

Testing targets will be more useful if the following improvements are made:

a. The target should be mounted on a flat piece of masonite, wallboard, or similar material.

b. To insure stability of the testing target throughout boresighting, it should be fastened securely to a stand (fig. 17).

c. For use in either leveling or canting the testing target, a mil scale may be inscribed at the bottom of the target. A small nail at the top

Figure 17. Rear view of testing target stand.

marks the center from which an arc was drawn and provides a hook from which to suspend the plumb line (fig. 18).

d. A vertical reference line (fig. 18) may be drawn through the center of each diagram. These lines may be used when the trunnions cannot be leveled by setting the testing target with the cant angle of the piece. The target is tilted until the line of sight through the tube tracks between the

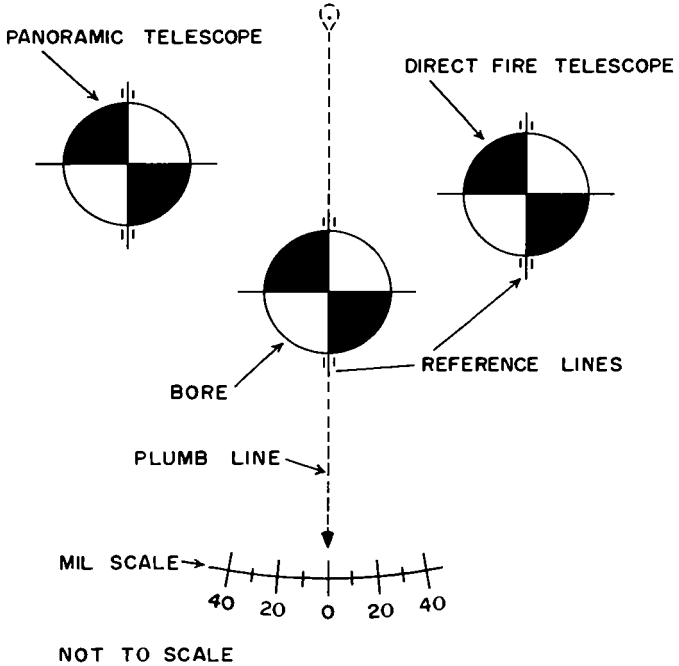


Figure 18. Testing target with mil scale and vertical reference lines.

tube reference line when the tube is elevated or depressed. Then the panoramic telescope is adjusted so that its vertical crosshair tracks between the appropriate reference lines when the tube is elevated or depressed.

e. To facilitate boresighting in darkness, a $\frac{1}{16}$-inch hole may be bored through the mounted testing target at the center of each aiming diagram. A flashlight held against the target behind the appropriate hole provides an aiming point for use in blackout conditions. Patches of felt padding should be fastened on the back of the target covering the regions of each hole, so that light from the flashlight will not escape. The flashlight must be lit only after it is placed firmly in position. Care must be taken to prevent disturbing the position of the testing target.

f. If the proper testing target is not available, a substitute with aiming diagrams for the bore and panoramic telescope may be constructed in accordance with the dimensions shown in TM 9–2300–216–10.

113. Cease Firing

The command CEASE FIRING normally is given to the section by the chief of section, but in emergencies anyone present may give the command. At this command, regardless of its source, firing ceases immediately. If the piece is loaded, the chief of section reports that fact to the executive. The executive acknowledges this announcement by saying "number (so-and-so) loaded." If CEASE FIRING is commanded by the fire direc-

tion center, firing is resumed at the announcement of the quadrant. If CEASE FIRING is commanded from within the firing battery, the executive investigates the condition that caused the command to be given. When the condition is corrected, firing is resumed at the executive's command of QUADRANT (so much).

114. Changes in Data During Firing

If it is necessary to correct any element of firing data, all firing previously ordered but not yet executed is stopped by the command CEASE FIRING. Corrected data is then announced. If the piece is not loaded, the new data is set off and firing is resumed at the command QUADRANT (so much). If the piece is loaded and no change in the fuze setting is required or if the piece is loaded with a percussion-fuzed shell, the new data is set off and firing is resumed at the command QUADRANT (so much). If the piece is loaded with time-fuzed shell and a change is required in the fuze setting, the chief of section suspends firing and reports that fact to the executive; for example, "No. 2 loaded, time (so much)." The piece will not be unloaded unless directed by the executive. In continuous fire, changes in data are so applied as not to stop the fire or break its continuity.

115. To Unload the Piece

A complete round, once loaded, should always be fired in preference to being unloaded unless military necessity dictates otherwise. The piece

will be unloaded only on the specific order and under the direct supervision of an officer. To unload the 175-mm gun or the 8-inch howitzer (TM 9–2300–216–10), the command is UNLOAD, and the operation is performed as follows:

a. The chief of section has the primer and firing mechanism removed, the breech opened, the powder charge withdrawn, the chamber filled with waste, the breech closed, and the tube depressed to zero elevation.

b. Numbers 3 and 4 insert the unloading rammer into the muzzle end of the tube and push carefully until the rammer head encircles the fuze and contacts the projectile. Steadily increasing pressure is applied by tapping the end of the rammer staff with a wooden block, if necessary, to loosen the projectile.

c. When the projectile is loosened, Nos. 3 and 4 suspend operation of the rammer while the chief of section has the breech opened and the waste removed. Number 1 then places the loading trough and loading tray in position in the breech to receive the projectile. As the tube is elevated to the load position (approx. 180 mils), the chief of section, standing at the breech end of the bore, holds a section of rammer staff, if available, or a similar item, firmly against the base of the projectile. He steadies its backward movement as the assistant gunner and No. 2 push the projectile onto the loading trough.

d. After it is unloaded, the projectile is disposed of as directed by the chief of section.

e. For further information on unloading, see FM 6–140 and TM 9–2300–216–10. For instruction concerning misfires, see paragraph 36, TM 9–2300–216–10.

116. Care of Ammunition

a. To insure uniform results in firing, to prolong the life of the tube, and to avoid accidents, care must be exercised in the storage and handling of ammunition at the battery. Provisions of TM 9–1900 applicable to field service should be followed carefully. In the field, conditions existing in each position will determine the amount of time, labor, and materials required to store and preserve the ammunition adequately. If the position is to be occupied for only a few hours, a tarpaulin spread on the ground may be sufficient; for longer periods of time, more elaborate facilities should be provided.

b. Ammunition must be protected from damage. When projectiles are received, they should be sorted into lots and placed in the best available storage. Ammunition data cards should be kept until all ammunition for that lot is expended. The eyebolt lifting plug should not be removed from unfuzed projectiles until the fuze is to be inserted. Protection should be provided against moisture, dirt, direct rays of sun and, as far as practicable, artillery fire and bombing. Protection against weather, dirt, and sun may be obtained by the use of tarpaulin and dunnage. Projectiles stacked in the open should be raised off the ground at least 6 inches. If drainage is not

good, ditches should be dug around the stacks. A liberal use of dunnage should be made between layers, and covering tarpaulins should be raised at least 6 inches from the stack to insure adequate ventilation. Ammunition for the 175-mm gun and 8-inch howitzer should be stacked in a single layer and each stack should contain not more than 25 rounds. Stacks should be at least 10 yards apart.

c. Powder charges should be sorted into lots and protected from sources of high temperatures, including direct rays of the sun. More uniform firing is obtained if the charges are of the same temperature. Powder charges should not be removed from containers until just before firing.

d. Explosive elements in primers and fuzes are particularly sensitive to shock and high temperature; therefore, strict attention should be given to their care and handling. Protection and safety devices should not be removed from fuzes until just before use. No attempt should ever be made to disassemble a fuze into its components.

e. For further information on care of ammunition, see FM 6–40, FM 6–140, TM 9–1900, TM 9–1300–203, and TM 9–3038.

117. Section Data Board

When a position is occupied for more than a few hours, data boards may be used by each section to record such items as deflections to aiming points, calibration corrections when appropriate, minimum elevations, data for the barrage and counterpreparations, and other data which may

be needed quickly. If such information assumes a standard pattern, the section may paint a form on a convenient part of the weapon and chalk in the various items of information in the appropriate spaces.

CHAPTER 8

BORESIGHTING

Section I. GENERAL

118. Description

a. Boresighting is the process of verifying that the optical axis of the on-carriage fire control equipment is parallel with the axis of the tube of the weapon, both for deflection and for elevation. Any misalinement discovered through boresighting is corrected as described in paragraphs 122 through 125. The tube should be placed near its center of traverse prior to boresighting. All instruments and mounts must be positioned securely; there must be no free play. Boresighting is conducted before firing and, when necessary, during lulls in firing.

b. There are four methods of boresighting these weapons.

(1) Testing target method (pars. 122–125).

(2) Distant aiming point method (pars. 126 and 127).

(3) Standard angle method (pars. 128–131).

(4) Aiming circle method (pars. 132–135.)

119. Equipment

The following equipment is needed for boresighting:

a. Boresights. Front and rear boresights or improvised substitutes are necessary for all but the standard angle method for boresighting. If boresights are not available, crosshairs may be fastened on the muzzle, and the obturator spindle vent may be used as a rear sighting guide.

b. Testing Target. A testing target or suitable substitute is needed for preparatory steps in testing and for certain methods of boresighting. If a testing target is not available, a clearly defined aiming point 3,000 or more meters from the piece may be used to accomplish approximately the same purpose as the testing target.

c. Tools. The section equipment includes all the necessary tools for boresighting and testing. If any item of sighting and fire control equipment fails to meet the prescribed tests, ordnance maintenance personnel must be notified.

120. Conditions

The on-carriage fire control equipment is in correct alinement when the conditions in *a* through *d* below exist.

a. Mounts and instruments are securely attached, and there is no binding or excessive backlash between the gears.

b. The lines of sight of on-carriage sighting equipment are parallel to the axis of the bore throughout the limits of elevation.

c. Elevation counter dials read zero.

d. The azimuth counter dial reads 3200.

e. All level bubbles are centered.

121. Leveling

a. Trunnions. Although it is not absolutely necessary to level the trunnions for boresighting, it is advisable to do so whenever possible. Accurate results can be obtained more readily if the trunnions are level, because a tilt corresponding to the cant does not have to be introduced in the telescope mount and the testing target when it is used. The trunnions can be leveled by moving the carriage to level ground or by building up the standing for one of the motor carriage tracks. In no case should there be more than 20 mils of cant.

b. Plumb Line. The best method to check leveling is by means of the plumb line. The line is suspended directly in front of the axis of the bore at a distance of approximately 15 feet. The line of sight should track the plumb line as the tube is depressed and elevated between minimum elevation and the limits described by a plumb line which is as long as practicable. The plumb line must be shielded from wind currents, and the plumb bob or weight should be suspended in a container of liquid in order to keep the plumb line taut (fig. 19).

c. Gunner's Quadrant. In leveling operations in which the gunner's quadrant is used, a quadrant that has been tested (par. 138) and found to be accurate is required. The gunner's quadrant is placed on the flat sur-

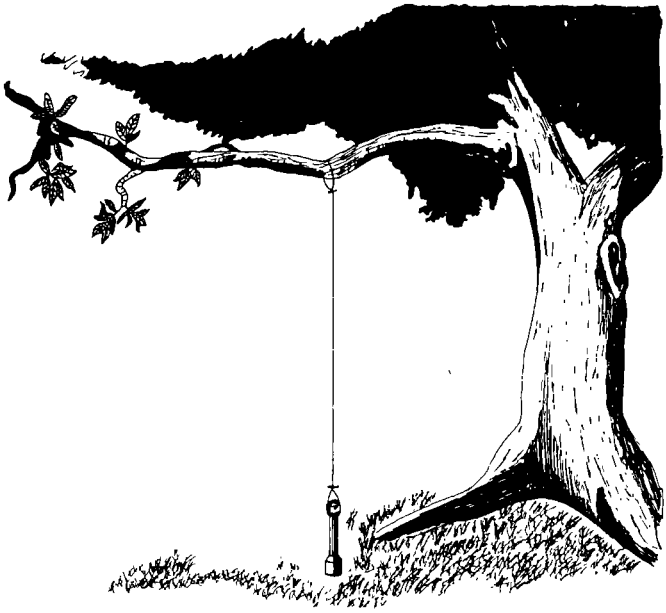


Figure 19. Plumb line suspended from tree.

face of the recoil housing, beneath the breechblock. Since there are no quadrant seats at this location, only approximate leveling may be accomplished by this method.

Section II. TESTING TARGET METHOD

122. General

The testing target method of boresighting consists of using the aiming diagrams of the testing target as aiming points. The preliminary steps in boresighting are as follows:

a. Trunnions. Level the trunnions as described in paragraph 121*a*.

b. Tube. Level the tube by using the gunner's quadrant on the leveling plates of the breech ring. Make certain that the shoes on the gunner's quadrant are positioned between the engraved lines on the leveling plates.

c. Boresights. Open the breech and insert the breech boresight in the chamber. Attach the muzzle boresight, stretching linen cords across the witness marks and over the cords on the muzzle and securing the ends by placing a strap around the end of the muzzle. If the breech boresight is not available, the obturator spindle vent may be used.

d. Testing Target Alinement. The testing target normally should be located at least 50 meters in front of the muzzle. If the trunnions are level, level the testing target by means of a plumb line or the vertical reference lines. If the trunnions are not level, cant the target to correspond to the cant of the trunnions. In either case, the face of the target is perpendicular to the axis of the bore, both laterally and longitudinally. Without moving the piece, except for elevating and depressing slightly when using testing target reference lines, aline the tube testing target diagram with the line of sight through the tube.

e. Telescope Mount M137. The level of the M137 telescope mount is checked by insuring that the bubbles in the elevation level and cross-level level vials are accurately centered.

f. Elevation Quadrant M15. The level of the M15 elevation quadrant is checked by insuring that the bubbles in the elevation level and cross-level level vials are accurately centered.

123. Elevation Counters

To make the reading on the elevation counter of the M137 telescope mount and the reading on the elevation quadrant agree with the tube elevation, place the gunner's quadrant on the leveling plates and elevate or depress the tube to zero elevation. Rotate the elevation knob until the elevation counter dial reads 0. If the bubble in the elevation level vial is not centered, turn the elevation correction knob in the appropriate direction until the bubble is centered, insuring that the cross-level level bubble is also centered. The figure which appears on the correction indicator dial is the correction which has been applied to the elevation counter. This correction must appear on the correction indicator dial for all subsequent quadrants set on the elevation counter dial in order for the elevation counter to indicate the correct elevation of the tube. If the elevation level bubble cannot be centered by turning the elevation correction knob, the elevation counter must be adjusted by ordnance personnel.

124. Direct Fire Telescope Alinement

After procedures prescribed in paragraph 125 are performed, check the direct fire telescope to determine whether the reticle of the telescope coincides with the reticle pattern of the testing tar-

get. If it does not, adjust the boresight adjustments of the telescope mount until the reticle of the telescope coincides with the reticle pattern of the testing target. If the reticle of the telescope cannot be brought into coincidence with the reticle pattern of the testing target, the mount must be adjusted by ordnance personnel.

125. Panoramic Telescope Alinement

Rotate the elevation and azimuth knobs until the horizontal and vertical lines of the reticle pattern are alined with the horizontal and vertical lines on the panoramic telescope diagram on the testing target (insure that the gunner's aid index is at zero). The azimuth counter dial should now read 3200 mils; if it does not, turn the azimuth knob until the azimuth counter dial reads 3200 mils and adjust the slotted key (boresight adjustment) until the vertical line of the reticle pattern of the telescope is alined with vertical line of the panoramic telescope diagram on the testing target.

Section III. DISTANT AIMING POINT METHOD

126. General

The distant aiming point method consists of alining the optical axis of the on-carriage fire control equipment and the line of sight through the tube on a common point at least 3,000 meters from the piece and as near zero elevation as possible.

127. Procedure

The steps prescribed for the testing target method apply to the distant aiming point method, except that the boresights and optical sights are alined on the same point instead of on the diagrams on the testing target. Accurate cross-leveling of the trunnions is unnecessary when boresighting on a distant aiming point, because the lines of sight converge on a single point.

Section IV. STANDARD ANGLE METHOD

128. General

When existing conditions make other methods of boresighting impracticable, the standard angle method may be used. In this method, the alinement of the optical axis of the panoramic telescope parallel to the axis of the bore is tested and adjusted by referring to a selected point on the muzzle. The deflection and elevation angles necessary to refer the line of sight of the telescope to the selected point on the muzzle are referred to as the standard angles. After the standard angles have been determined, they may be used for a quick test of the alinement of the panoramic telescope when more precise methods cannot be used. Correction of misalinement, as a result of this test, should be verified by a more accurate method at the earliest opportunity. When the standard angle method of boresighting is being used, the recoiling parts must be in the same position with respect to the nonrecoiling parts as they were when the standard angles were determined.

Therefore, the recoil mechanism must be checked to see that it contains the proper amount of recoil oil before determining the standard angles. Standard angles are usable only as long as the same tube-carriage combination is intact. If either the tube or carriage is changed, new standard angles must be established.

129. Parallax

Parallax in the panoramic telescope must be eliminated. This is done by placing in front of the eyepiece lens a dark colored cardboard or metal parallax shield of the same diameter as the eyepiece lens housing (fig. 20). The shield should have an exactly centered hole one-sixteenth inch in diameter. A more permanent parallax shield may be constructed of brass or bronze shim stock. When the shield is constructed of metal, a series of fingers approximately three-sixteenths inch wide and one-fourth inch long separated by ¼-inch spaces should extend beyond the perimeter of the shield. These fingers should be bent along the circumference of the circle to form an angle of 90° with the surface of the shield. The fingers serve as a means of clipping the shield in place quickly and permit easy removal. If the eyepiece has a rubber eyeguard, the metal shield may be attached within the eyeguard.

130. Preliminary Operations

The ideal time to determine the standard angles for later use is after performing basic periodic tests when the trunnions are level and the

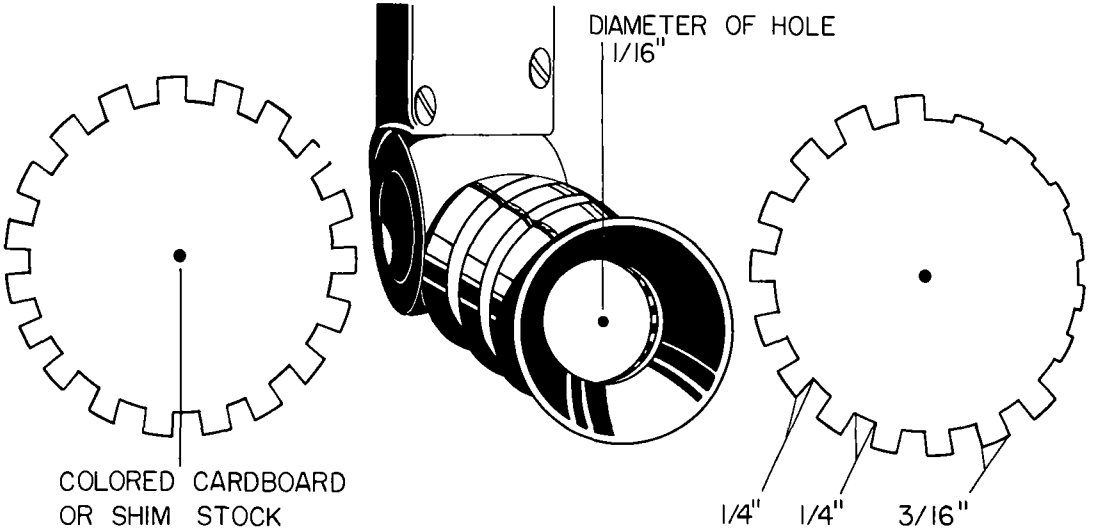


Figure 20. Parallax shield on eyepiece of telescope.

panoramic telescope mount is known to be in correct alinement. Procedure for determining standard angles is as follows:

a. With the tube in battery, scribe lines in the paint to mark the normal positions of the parts which move in recoil with respect to parts which do not move in recoil.

b. Boresight the piece by using a testing target or distant aiming point.

c. With friction tape, fasten a bright, straight pin in the left horizontal witness mark. Allow the pin to project to the left of the muzzle (fig. 21).

d. Fasten the parallax shield over the eyepiece of the panoramic telescope.

e. Verify that the elevation counter dial reads 0 mils and that the telescope mount is level.

f. Turn the azimuth knob and elevate or depress the tube as necessary and place the crosshairs of the sight on the pin in the left horizontal witness mark of the tube.

g. Verify that the telescope mount is level and that the horizontal and vertical lines of the telescope are exactly on the junction of the pin with the muzzle.

h. Read and record the deflection from the azimuth counter dial of the panoramic telescope to the nearest one-fourth mil. This is the standard azimuth angle for the piece tested.

i. With the gunner's quadrant seated on the quadrant seats, measure and record the elevation of the tube to the nearest one-fourth mil. This is the standard elevation angle for the piece tested.

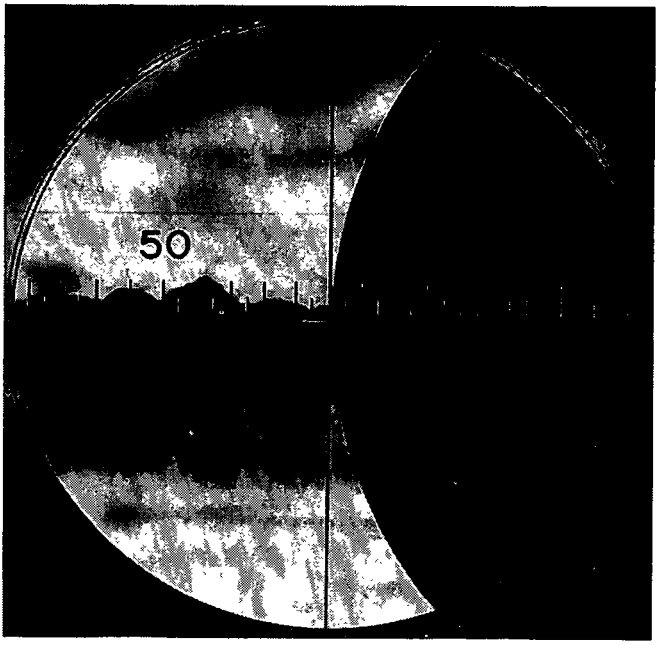


Figure 21. Sight picture of projecting pin.

131. Procedure

After the standard angles have been determined and recorded, the steps in performing the standard angle method of boresighting are as follows:

a. Verify that the parts that move in recoil are in the same position with respect to the nonrecoiling parts as they were when the standard angles were determined. If they are not in the same position, the amount of recoil oil in the recoil mechanism must be modified until the distance

from the end of the breech to the scribed line (par. 130*a*) is the same.

b. With friction tape, fasten a bright straight pin in the left horizontal witness mark so that the pin projects out to the left of the muzzle.

c. Place the parallax shield on the eyepiece of the telescope.

d. Set off the standard elevation angle (par. 130*i*).

e. Set off the standard azimuth angle on the azimuth counter dial of the panoramic telescope (par. 130*h*).

f. If the intersection of the crosshairs of the panoramic telescope is not exactly on the junction of the pin and the muzzle, the sight is out of adjustment. If the azimuth angle is in error, it may be corrected by section personnel by adjusting the slotted key (boresight adjustment).

Section V. AIMING CIRCLE METHOD

132. General

The aiming circle method may be used when weather or terrain prohibits the use of the testing target method or the distant aiming point method. The aiming circle method results only in correcting for deflection errors. It does not include a test for determining elevation errors. When this method is used, any adjustments made should be verified at the first opportunity by boresighting on a testing target or a distant aiming point. Before boresighting with the aiming circle, certain preparatory steps (par. 133) must have

been performed, preferably after a basic periodic test (pars. 60–62) when the panoramic telescope mount is in correct adjustment.

133. Preliminary Operations

a. Accuracy. The greatest care must be exercised in all phases of these operations. All final movements of the instruments must be made so that the vertical line of the reticle approaches the final position from left to right, in order to eliminate the effects of lost motion in the gears.

b. Parallax. Parallax in the aiming circle and the panoramic telescope must be eliminated. Parallax is eliminated in the aiming circle after focusing by placing in front of the eyepiece lens a dark colored cardboard or metal parallax shield of the same diameter as the eyepiece lens housing. The shield should have a vertically and horizontally leveled slot one-sixteenth inch wide and one-fourth inch long. It is held in place with adhesive tape around the edge of the focusing sleeve (fig. 22). To eliminate parallax in the panoramic telescope, a shield is placed on the eyepiece lens housing as described in paragraph 129.

c. Boresight marks. The aiming circle method requires that boresight marks be located on the top surface of the tube at the muzzle end and on the rear of the breech ring (fig. 23). The positions of these boresight marks must be accurately defined by painting a white stripe about 1 inch wide and several inches long on the tube and from the top of the breech ring to the breechblock carrier. The left edge of the stripe lies in the same

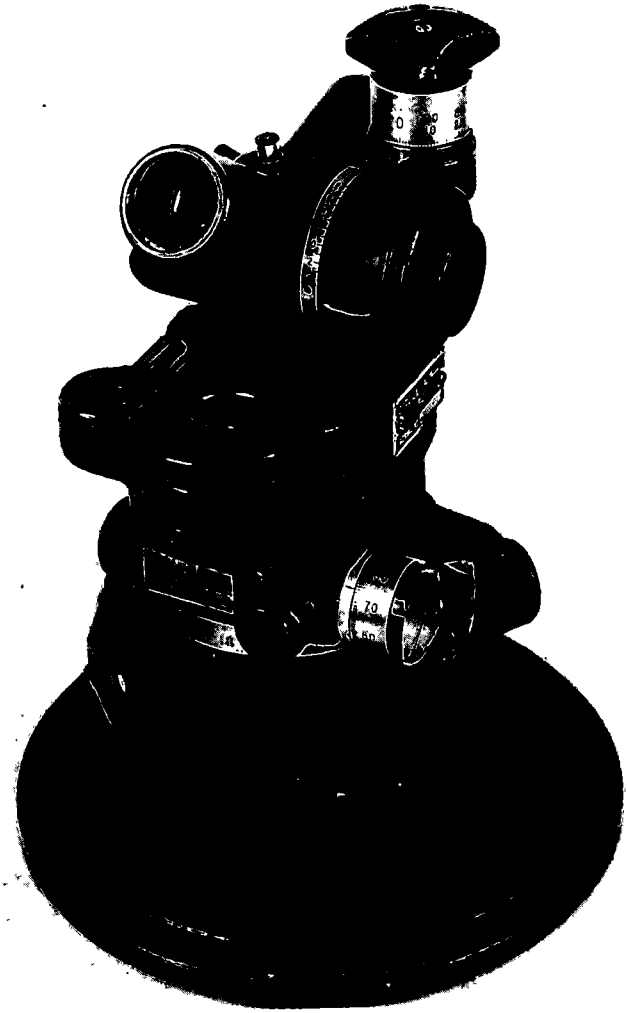


Figure 22. Parallax shield on eyepiece of aiming circle.

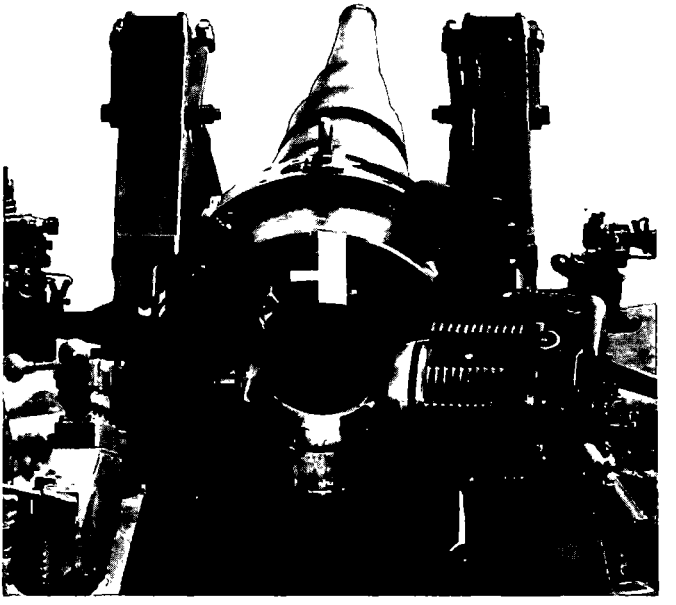


Figure 23. Boresight stripes with radius point indicated.

vertical plane as the exact center of the bore when the trunnions are level. The location of boresighting marks is determined as follows:

(1) Level the trunnions.

(2) Set up an aiming circle equipped with a parallax shield 30 to 50 meters directly in rear of the howitzer.

(3) Fasten crosshairs in the muzzle witness marks.

(4) With adhesive tape fasten a bright

straight pin in the top witness mark so that it projects above the muzzle.

(5) Place the breech boresight in place with the two finger holes vertical.

(6) Place a straightedge in a vertical position on the rear face of the breech ring and aline the right side of the straightedge with the center hole of the breech boresight and the vertical thread on the muzzle.

(7) Sight through the aiming circle and, if necessary, traverse the howitzer until the pin mounted on the muzzle and the right side of the straightedge are alined with the right edge of the vertical line of the aiming circle. Recheck the alinement of the straightedge with the boresight; then withdraw the boresight. Draw a pencil line along the left side of the straightedge on the upper rear portion of the breech ring (fig. 24).

(8) Lay the straightedge on the tube at the muzzle along the same line of sight and draw a pencil line. Elevate the tube if necessary. Paint a white stripe on the breechblock and the tube, exactly on the left edge of the pencil line.

(9) Open the breech. Elevate or depress the tube until the crosslines of the aiming circle reticle are again directly centered on the muzzle boresight.

(10) Measure the *outside* diameter of the muzzle with a ruler. Divide this meas-

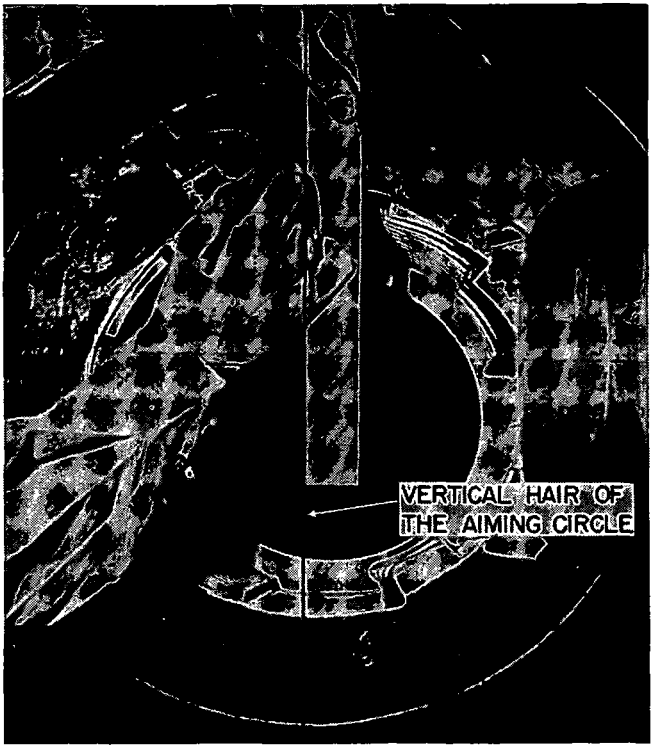


Figure 24. Drawing the breech boresight stripe.

urement by 2, thereby obtaining the radius, and lay off this distance on the straightedge. This distance is used in determining the location of the radius point.

(11) Open the breech (fig. 25). Place the left edge of the straightedge along the left edge of the breech boresight stripe (lo-

ever the piece fires inaccurately for no readily apparent reason. The tests will reveal whether the on-carriage sighting equipment, the gunner's quadrant, and the fuze setter are in correct adjustment.

137. Preliminary Conditions

For the on-carriage equipment to be in correct adjustment, the following conditions must exist:

a. The line of sight of the panoramic telescope remains in a plane parallel to the vertical plane passing through the axis of the bore as the tube is elevated throughout its limits of elevation.

b. Elevation counters read zero.

c. The azimuth counter dial reads 3200.

d. If the elevation level and cross-level level bubbles are centered, the telescope mount automatically compensates for error in azimuth caused by elevating the tube.

e. The sighting equipment is accurately boresighted as described in paragraphs 118 through 135.

f. Prior to all tests of on-carriage fire control equipment, it is essential that the trunnions be leveled accurately. Leveling the trunnions is most easily accomplished as prescribed in paragraph 121. The best method for checking the level of the trunnions is by tracking a plumb line as described in paragraph 12*b*. If a plumb line cannot be used, approximate leveling may be accomplished by placing the gunner's quadrant on the flat surface of the recoil housing, beneath the

CHAPTER 9
BASIC PERIODIC TESTS

Section I. GENERAL

136. Purpose and Scope

a. The purpose of this chapter is to describe the procedures for performing basic periodic tests of on-carriage fire control equipment. The procedures covered include only those that may be accomplished at battery level. It is not contemplated that using units will have the necessary facilities, tools, or skilled personnel to perform the more precise tests and adjustments of sighting and fire control equipment. If the elevation counter, telescope mount, or panoramic telescope exceeds the tolerance authorized on any of the tests outlined, the piece and/or panoramic telescope must be sent to ordnance for adjustment.

b. Basic periodic tests are performed by the section under the supervision of the battery executive and the artillery mechanic. These tests are performed at the discretion of the unit commander. Suggested times for performance are once each year if the piece is used for nonfiring training; once every 3 months if the piece is fired; as soon as possible after intensive use, accidents, or traversing extremely rough terrain; and when-

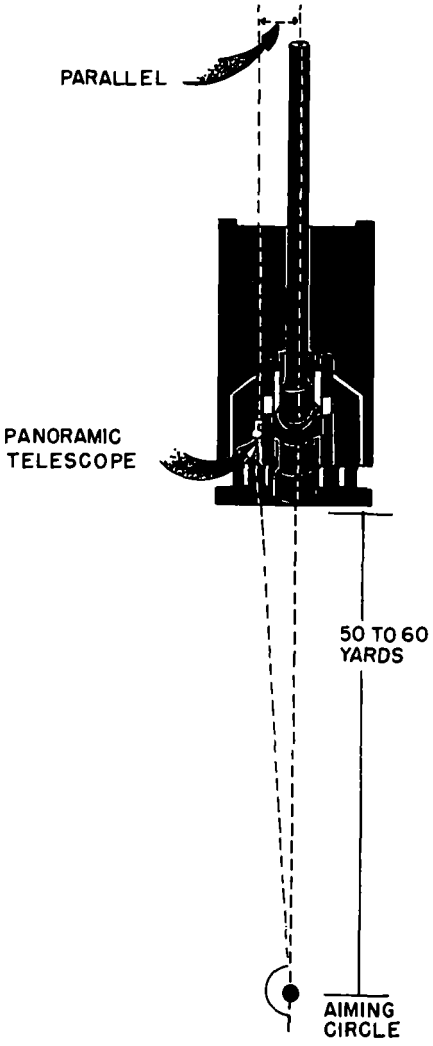


Figure 26. Measuring the boresighting angle with the aiming circle and panoramic telescope.

h. Read the angle on the azimuth scales of the aiming circle (fig. 26).

i. Set the angle read on the aiming circle (*h* above) on the azimuth counter dial of the panoramic telescope.

j. Adjust the slotted key (boresight adjustment) on the panoramic telescope until the vertical line of the telescope reticle is exactly on the center of the objective lens of the aiming circle. Recheck the angle settings and the alinement of the vertical lines. The optical axis of the panoramic telescope and the tube will now be parallel when deflection 3200 is set on the telescope.

135. Procedure (Trunnions not Level)

a. Perform the steps in 134*a* through *d.* When the trunnions are not level, sight on the boresight strips at prescribed points on the stripes. Aline the right edge of the vertical line of the aiming circle with the top left edge of the muzzle boresight stripe and with the radius point on the left edge of the breech boresight stripe. Insure that these two points are equidistant from the axis of the bore; if not, the line of sight through the aiming circle will not be parallel to a vertical plane through the axis of the bore and an error in alinement will result.

b. Proceed with the steps in 134*f* through *j* above.

134. Procedure—Trunnions Level

The howitzer having been prepared as in paragraph 133, the howitzer may be boresighted by the aiming circle method as follows:

a. Set up the aiming circle 30 to 50 meters in rear of the howitzer.

b. Zero the scales of the aiming circle and level the instrument.

c. Elevate the howitzer until the two boresighting marks are plainly visible from the aiming circle. Do not elevate the tube any more than is necessary for clear definition of the edges of the white boresight marks.

d. By traversing the howitzer and turning the lower motion of the aiming circle, place the right edge of the vertical line exactly in line with the left edge of the two boresight stripes.

e. Check that the trunnions are level by elevating and depressing the tube and noting if the two boresight stripes remain parallel to the right edge of the vertical hair of the aiming circle. If the trunnions are level, proceed with steps in *f* through *j* below; if they are not level, proceed as in paragraph 135.

f. Verify that the azimuth scales of the telescope are set at zero and that the indexes are in coincidence.

g. With the upper motion of the aiming circle, turn to the objective lens of the panoramic telescope. Make certain that equal amounts of the housing appear on each side of the vertical line.

cated in (7) above), with the base of the straightedge held where the horizontal line of the aiming circle reticle falls across the breech. Measure off the radius ((10) above) along the left edge of the breech boresight stripe, marking the distance with a pencil. This is the radius point.

(12) To make the radius point easy to identify, paint a horizontal white line to the left of the boresight stripe. This line should be painted so that the intersection of the top of the horizontal line and the left edge of the breech boresight stripe will be the radius point.

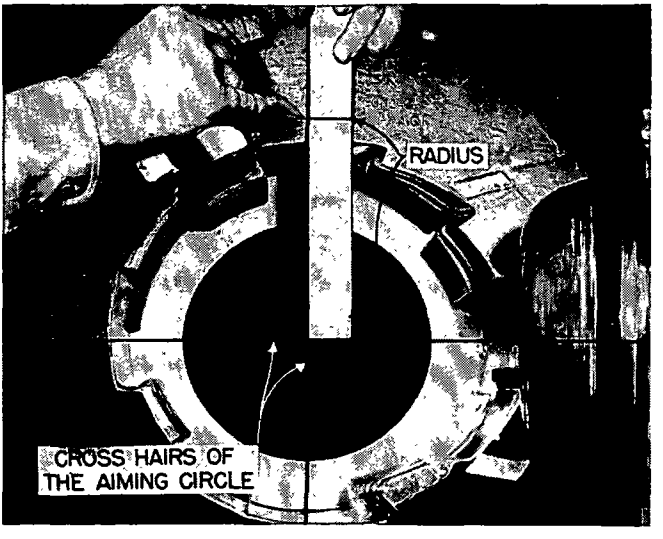


Figure 25. Establishing the radius point.

breechblock. Trunnions may also be leveled by emplacing an aiming circle to the rear of the piece and alining the boresight stripes with the vertical crosshair of the aiming circle.

g. Parallax shields for the panoramic telescope and the direct fire telescope must be prepared in order to eliminate parallax in viewing a plumb line or a testing target (par. 129).

Section II. TEST OF GUNNER'S QUADRANT

138. General

The gunner's quadrant must be in proper adjustment before conducting tests and adjustments of other sighting and fire control equipment. Inspect the shoes of the gunner's quadrant for dirt, nicks, or burrs. Similarly, inspect the leveling plates on the upper surface of the breech ring and the quadrant seats on the telescope mount and elevating quadrant. Dirt, nicks, or burrs on these surfaces will cause the inaccurate readings.

139. End-For-End Test

a. Set both the index arm and the micrometer scale of the gunner's quadrant at zero, making sure the auxiliary indexes match.

b. Place the quadrant on the leveling plates of the breech ring with the line-of-fire arrow pointing toward the muzzle, and center the quadrant bubble by turning the elevating handwheel.

c. Reverse the quadrant on the leveling plates (turn it end-for-end). If the bubble recenters,

the quadrant is in adjustment and the test is completed.

d. If the bubble does not recenter, try to center it by turning the micrometer knob. If the bubble centers, read the black figures and divide by 2. The quotient is the correction. Place the correction on the micrometer and level the tube by using the elevation handwheel. Check again by reversing the quadrant. The bubble should center.

e. If the bubble does not center as in *d* above, move the radial arm down one graduation (10 mils) and perform the following operations: Turn the micrometer until the bubble centers; add 10 to the reading on the micrometer, and divide the sum by 2. Place the value of the quotient reading on the micrometer, leaving the arm at minus 10; center the level bubble with the elevation handwheel; and check by reversing the quadrant on the seats. The bubble should recenter. If the correction of error is more than plus or minus 0.4 mil, the quadrant must be adjusted by ordnance maintenance personnel.

140. Micrometer Test

a. Set the radial arm to read 10 mils on the elevation scale, and set the micrometer at 0.

b. Place the quadrant on the leveling plates on the breech ring with the line-of-fire arrow pointing toward the muzzle, and center the quadrant bubble by elevating the tube.

c. Set the radial arm at 0 on the elevation scale, and set the micrometer at 10 mils.

d. Reseat the quadrant on the leveling plates. The bubble should center.

Caution: **Do not disturb the laying of the tube.**

e. If the bubble does not center, the micrometer is in error and must be adjusted by ordnance maintenance personnel.

141. Comparison Test

Compare readings taken at low, medium, and high elevations with each of the gunner's quadrants of a battery on the quadrant seats of a *single* piece. The trunnions of this piece should be level. Any quadrant differing from the average by more than 0.4 mil at any elevation should be sent to an ordnance maintenance unit for adjustment.

142. Correction

When a gunner's quadrant requires a correction as determined by the end-for-end test, this correction is not carried during firing, but it is recorded and applied only when tests are being made.

Section III. TESTS FOR TELESCOPE MOUNT M137, PANORAMIC TELESCOPE, AND ELEVATION QUADRANT M15

143. Purpose

The purpose of the tests for the telescope mount M137, the panoramic telescope, and the elevation quadrant M15 is to determine whether the azimuth counter and level vials actually estab-

lish the tube (regardless of cant) in the correct vertical plane at all elevations. These tests are performed to check the adjustment and mounting of the panoramic telescope mount, the accuracy of the level vials, and the alinement of the telescope socket. The test of the telescope mount described in paragraph 144 may be performed with the trunnions either level or canted. It reflects total errors of the entire mechanism. Because compensating errors of various parts of the mount may result in the weapon's testing out properly, the other tests specified in paragraphs 145 through 149 must be performed regardless of the test in paragraph 144. The total error found in this test may then be reduced to errors in specific components.

144. Test of Telescope Mount M137

a. Procedure Using a Plumb Line.

(1) With the boresights in place and the tube at a low elevation, traverse the tube so that the line of sight through the tube is on the plumb line; level the telescope mount by centering both the elevation level and cross-level level bubbles.

(2) Place the intersection of the crosshairs of the panoramic telescope reticle on any sharply defined aiming point and note the deflection.

(3) Elevate the tube from minimum to maximum elevation (or limit of the plumb line) in 100-mil steps. At each step, traverse the tube (if necessary) to bring

the line of sight back on the plumb line. Relevel the telescope mount in both directions and check for deviation of the line of sight from the aiming point. If the vertical crosshair is off the aiming point, it is alined on the aiming point with the azimuth knob. If the horizontal crosshair is off the aiming point, it is alined on the aiming point with the elevation knob, and the bubble displacement is noted.

(4) If the vertical crosshair deviates from the aiming point by more than one-half mil from the original deflection at any elevation tested or the correction for the deviation of the horizontal crosshair causes either level bubble to move in excess of one-half vial graduation, the telescope mount is out of adjustment or improperly mounted. The weapon must be referred to ordnance maintenance personnel for adjustment or correction.

b. Procedure Using an Aiming Circle.

(1) Emplace an aiming circle approximately 50 meters to the rear of the piece. With the tube at the lowest elevation at which the boresight stripes on both the breech and the muzzle can be seen through the aiming circle, aline the vertical hairline of the aiming circle with the boresight stripes.

(2) Place the intersection of the crosshairs

of the panoramic telescope reticle on any sharply defined aiming point and note the deflection.

(3) Elevate the tube from minimum to maximum elevation in 100 mil steps. At each step, traverse the tube if necessary to aline the boresight stripes with the vertical hairline of the aiming circle. Relevel the telescope mount in both directions and check for deviation of the line of sight from the aiming point. If the vertical crosshair is off the aiming point, it is turned to the aiming point with the azimuth knob. If the horizontal crosshair is off the aiming point, it is brought to the aiming point with the elevation knob, and the bubble displacement is noted.

(4) If the vertical crosshair of the panoramic telescope deviates from the original deflection by more than one-half mil at any elevation tested or the correction for the deviation of the horizontal crosshair causes either bubble to move in excess of one-half vial graduation, the telescope mount is out of adjustment or improperly mounted. In this case, the weapon must be referred to ordnance for adjustment or correction.

145. Test of Cross-Level Setting, Telescope Mount M137

a. Level the telescope mount M137 in both directions by centering the level bubbles.

b. Set the line of sight of the panoramic telescope at 3200 with the parallax shield in place.

c. Suspend a plumb line to coincide with the vertical crosshair of the telescope reticle.

d. Turn the elevation knob of the panoramic telescope through the entire range of movement. If the line of sight deviates from the plumb line by more than one-half mil, the level vials are out of adjustment and must be adjusted by ordnance maintenance personnel.

146. Test of Longitudinal-Level Setting, Telescope Mount M137

a. Level the telescope mount M137 in both directions by centering the level bubbles.

b. With the parallax shield in place, by turning the azimuth knob of the panoramic telescope, set the line of sight to 1,600 mils.

c. Suspend a plumb line to coincide with the vertical crosshair of the panoramic telescope.

d. Turn the crosslevel correction knob on the telescope mount through the entire range of movement. If the line of sight deviates from the plumb line by more than 1 mil, adjustment of the level vials is necessary. This adjustment must be performed by ordnance maintenance personnel only.

147. Test for Panoramic Telescope

a. Set the azimuth counter dial at 3200.

b. Traverse and elevate the tube as necessary

to place the panoramic telescope reticle crosshairs on an aiming point.

c. Rotate the telescope head through a complete circle (6,400 mils). The telescope crosshairs should return to within 1 mil of the aiming point.

148. Test of Elevation Counter, Telescope Mount M137

Using a gunner's quadrant that has been checked for accuracy, measure the elevation of the tube at 0, 225, 625, 1,025, and 1,155 mils by placing the gunner's quadrant on the leveling plates and leveling the bubble of the gunner's quadrant. Turn the elevation knob until the elevation level bubble is centered at each elevation and insure that the cross-level level bubble is centered. Check the readings of the elevation counter against the readings of the gunner's quadrant. If the two readings do not agree and the disagreement is constant at all elevations, the appropriate correction is applied to the elevation correction indicator dial. If the magnitude of the disagreement between the two readings varies with elevation of the tube, the elevation counter is out of adjustment and must be referred to ordnance maintenance personnel.

149. Test of Elevation Quadrant M15

The elevation quadrant M15 is tested in the same manner as the elevation counter of the telescope mount M137 (par. 148).

Section IV. TEST OF FUZE SETTERS

150. General

Examine the stop which fits into the slot in the movable time ring and the adjusting pawl which engages the notch in the fixed fuze ring to see that their edges are not burred or bent. Depress the adjustable pawl against its spring to see that the movement of the pawl is free. In the following tests, be sure to test the fuze setter with the fuze for which it is designed; the time scale on the fuze setter must have the same graduations as the time ring on the fuze.

151. Time Scale Test

Set any convenient time on the scale. Test the time scale of the fuze setter by setting several fuzes.

152. Precaution

a. Before setting a fuze, make sure the "T" of the fuze setter is rotated. The time set on the fuze should agree with the time setting on the fuze setter within one-fourth of the smallest graduation on the fuze time ring. The amount of tolerance is 0.05 second for fuzes with 0.2-second graduations and 0.125 second for fuzes with 0.5-second graduations. If the fuzes set do not agree with the time set on the fuze setter, repeat the test as a check with a different setting. If the fuzes set still do not agree with the fuze setter, refer the instrument to an ordnance maintenance unit for adjustment.

b. Do not set any one live fuze more than twice. The fuze from a dud must never be used. Reset all fuzes to SAFE and replace the safety wire or cotter pin.

CHAPTER 10

MAINTENANCE AND INSPECTIONS

153. General

Maintenance and inspection are essential to insure that the section is prepared to carry out its mission immediately. Systematic maintenance and inspection drills provide the best insurance against unexpected breakdown at the critical moment when maximum performance is essential.

154. Disassembly, Adjustment, and Assembly

Disassemblies and adjustments authorized to be performed on the weapon by battery personnel are prescribed in TM 9–2300–216–10 supplemented by instructions in Department of the Army supply manuals. No deviation from these procedures is permitted unless authorized by the responsible ordnance officer.

155. Records

a. The principal records pertaining to the weapon are the Weapon Record Book (DA Form 9–13 and DA Form 9–13–1), a field report of accidents (AR 385–63), and the Unsatisfactory Equipment Report (DA Form 468). Information on the purpose and use of these records is printed on the records themselves.

b. The principal records pertaining to the motor carriage and the section vehicle are the vehicle technical manual, lubrication order, accident report (Standard Form 91), and equipment record book. Information on the purpose and use of these records is printed on the records themselves.

c. The chiefs of section and the battery executive also should keep semipermanent records on the weapons and vehicle for information and guidance.

156. Maintenance

For detailed instructions concerning maintenance of the 175-mm gun M107 and the 8-inch howitzer M110, see TM 9–2300–216–10.

157. Inspections

Regular inspections are required to insure that materiel is maintained in serviceable condition.

a. The chief of section is responsible for the equipment within his section. He should inspect it thoroughly each day. If he sees the need for repair or adjustment, he notifies the battery executive immediately so that the necessary action may be taken.

b. The battery executive, accompanied by the artillery mechanic, should make a daily spot check inspection. He inspects different parts of the weapons and motor carriages each day to insure complete coverage every few days. At least once a month, the battery executive makes a thorough mechanical inspection of weapons, motor car-

riages, auxiliary equipment, tools, and spare parts.

c. Battery, battalion, and higher commanders should make frequent command inspections to assure themselves that the equipment in their commands is being maintained at prescribed standards of appearance, condition, and completeness.

d. For details on inspecting the 175-mm gun M107 and inspecting the 8-inch howitzer M110 see TM 9–2300–216–10 and TM 9–2350–210–12.

e. Duties of individuals in performing the necessary inspections and maintenance of the section vehicle, weapon, and carriage are given in table VI. Work will be made routine, thorough, and rapid by following the drills outlined in table VI. When the section is reduced in strength, the chief of section must reassign duties to insure that all maintenance is performed.

Table VI. Duties in Inspection and Maintenance
(Located in back of manual)

158. Duties in Inspection Before Operation (March)

The inspection performed before operation is a final check on materiel prior to leaving the motor park for training in the field or the bivouac area for combat or before displacement. Boresighting is accomplished at this inspection, if time permits. After inspection and after all deficiencies have been corrected, the weapon and carriage are ready for action. For duties of section personnel, see table VI.

159. Duties in Inspection During Operation (March)

The inspections performed during operation are constant checks on the functioning of the vehicles and the security of all stowed equipment. The responsibilities and duties of section personnel are as follows:

a. The chief of section and the ammunition specialist supervise march discipline of the motor carriage and section vehicle, respectively, and assist the drivers in detecting obstacles that would cause injury to personnel or damage to the vehicles.

b. The gunner, assistant gunner, and cannoneers inspect security of stowed equipment and act as air sentinels as directed by the chief of section.

c. The drivers operate their respective vehicles and inspect all instruments and controls.

160. Duties in Inspection During Halt

The inspection at the halt is made to insure that the motor carriage, weapon, and section vehicle are in satisfactory operational condition. The halt provides the section with an opportunity to inspect for malfunctions that cannot be detected during operation. Each member of the section checks those items listed in table VI, as appropriate.

161. Duties in Inspection and Maintenance After Operation

Immediately after operation, the motor carriage, weapon, and section vehicle are serviced

and maintained as necessary to prepare them for further sustained action or to determine the need for maintenance by higher echelons. Boresighting is accomplished, if time permits. These operations may be performed in the motor park, bivouac area, or combat position. Individual duties of gun (howitzer) section personnel are listed in table VI.

162. Duties in Weekly Inspection and Maintenance

In garrison, inspection and maintenance duties are performed weekly; on maneuver or in combat, they are performed after each field operation.

a. Chief of Section. The chief of section supervises the section in weekly inspection and maintenance of the gun (howitzer) motor carriage, section vehicle, tools, accessories, and equipment (TM 9–2300–216–10 and LO 9–2300–216–10). He obtains assistance of the artillery mechanic and battery mechanic for operations requiring skill and tools beyond the capabilities of the section.

b. Gunner, Assistant Gunner, and Cannoneers. The gunner, assistant gunner, and cannoneers perform normal maintenance as directed by the chief of section.

c. Drivers. The drivers perform normal preventive maintenance services in accordance with appropriate technical manuals.

CHAPTER 11

DECONTAMINATION OF EQUIPMENT

163. General

Equipment which has been contaminated by chemical, biological, or radiological agents constitutes a danger to personnel. *Contamination* means the spreading of an injurious agent in any form and by any means. Persons, objects, or terrain may be contaminated. *Decontamination* is the process of making any contaminated place or thing safe for unprotected personnel. This can be done by covering, removing, destroying, or changing into harmless substances the contaminating agent or agents. Generally, only equipment contaminated by persistent agents need be decontaminated.

164. Decontamination for Chemical Agents

a. Ammunition. With rags, wipe off visible contaminant from projectiles. Apply DANC (decontamination agent, noncorrosive, M4), wipe with solvent-soaked rag, and then dry. If DANC is not available, scrub with soap and cool water. Slurry (equal weights of water and chloride of lime) can be used on contaminated ammunition containers, but it must not be allowed to penetrate into the ammunition itself.

b. Instruments. If exposed to corrosive gases, clean instruments as soon as possible with solvent, allow them to aerate, and apply a thin coat of light machine oil. A rag dampened with DANC may be used, followed by drying with a clean rag and then applying a coat of machine oil. DANC injures clear plastic or hard rubber surfaces.

c. Weapons. Remove dirt, dust, grease, and oil from weapons. Do not apply wet mix but allow surfaces to air after oil and dirt have been removed. DANC can be used on all metal surfaces except the bore. Also effective on metal are hot water and soap or cleaning solvent. After decontamination, weapons are dried and oiled.

d. Automotive Equipment. Exposure to the air can neutralize light contamination from spray. For heavy contamination, use DANC on interior or exterior surfaces that personnel are likely to touch. For large areas decontamination, wash vehicle with water and scrub painted surfaces with soap and water.

165. Decontamination for Biological and Radiological Agents

a. General. After a contaminating attack, recovery of equipment may be achieved either by waiting, to permit the decay of contamination, or by active decontamination, to reduce the danger to a level where it is no longer a significant hazard to operating personnel. Decontamination may be either rough or detailed, depending on the urgency of the military situation. The procedure adopted will be a command decision.

b. Rough Decontamination. Rough decontamination is performed when urgency is the main factor. Its purpose is to reduce contamination sufficiently to permit personnel to work with, or close to, equipment for limited periods. Rough decontamination may be achieved by means of water or steam, if available. Soap or other detergent used in conjunction with water or steam aids in decontamination.

c. Detailed Decontamination. Detailed decontamination, in which the emphasis is on thoroughness, will be carried out in rear areas and repair bases and includes procedures of surface decontamination, aging, sealing, and disposal.

166. References

For further information on decontamination, see FM 21–40, TM 3–220, and TF 3–1407.

CHAPTER 12
DESTRUCTION OF EQUIPMENT

167. General

a. Tactical situations may arise in which it is necessary to abandon equipment in the combat zone. In such a situation, all abandoned equipment must be destroyed to prevent its use by the enemy.

b. The destruction of equipment subject to capture or abandonment in the combat zone will be undertaken only upon authority delegated by a division or higher commander.

168. Plans

All batteries will prepare plans for destroying their equipment in order to reduce the time required should destruction become necessary. The principles to be followed are—

a. Plans for destruction of equipment must be adequate, uniform, and easily carried out in the field.

b. Destruction must be as complete as the available time, equipment, and personnel will permit. Since complete destruction requires considerable time, *priorities* must be established so that the more essential parts are destroyed first.

c. The same essential parts must be destroyed on all like units to prevent the enemy from constructing a complete unit from undamaged parts.

d. Spare parts and accessories must be given the same priorities as the parts installed on the equipment.

169. Methods

To destroy equipment adequately and uniformly, all personnel of the unit must know the plan and priority of destruction and be trained in the methods of destruction.

170. References

For detailed information on destruction of the 175-mm gun M107, 8-inch howitzer M110, fire control equipment, and the motor carriage, see TM 9–2300–216–10; for destruction of ammunition, see TM 9–1300–203.

CHAPTER 13
SAFETY PRECAUTIONS

171. General

Safety precautions to be observed in training are prescribed in AR 385–63. Additional information is found in FM 6–40, FM 6–140, TM 9–1300–203, TM 9–2350–210–12, and TM 9–2300–216–10. The more important safety precautions are summarized in paragraphs 172 through 175.

172. Ammunition

a. All ammunition on the ground at the firing position must be so placed that it is protected against explosion in case of an accident at the piece. Fire and explosive or flammable materials must be kept away from ammunition. Ammunition should be protected from direct rays of the sun by use of a tarpaulin or other suitable covering.

b. Battery personnel must not attempt to disassemble fuzes.

c. If for any reason a round is not fired after the time fuze has been set, the fuze must be reset to SAFE before it is restowed. M514-series VT fuzes must be reset to initial setting as shipped.

d. All rounds not fired which have been prepared for firing must be checked by the chief of

section to insure that all powder increments are present in proper order and condition and that they are of the proper lot number. For further details, see FM 6–40 and FM 6–140.

173. Misfires

a. In the event of a misfire, two more attempts are made to fire the piece.

Caution: **The piece should remain as laid and all personnel must stay clear of the muzzle and path of recoil. All personnel not required for the operation should be cleared from the vicinity.**

b. If the primer is heard to fire, a minimum wait of 10 minutes will be allowed before the breech is opened and the faulty charge removed. The faulty charge and the unused increments and igniter pads must be stored separately from other charges and disposed of (see TM 9–1900 for further details).

c. If the primer is not heard to fire, two more attempts are made to fire the piece. If, after the third attempt, the primer is not heard to fire, proceed as follows:

(1) Wait 5 minutes. If the primer can be removed by No. 1 standing clear of the path of recoil, the primer may be removed and new one inserted.

(2) If the primer cannot be removed safely as described in (1) above, no attempt will be made to open the breech or replace the primer for 10 minutes.

d. Misfire primers should be handled carefully and disposed of quickly since there is a possibility of a primer hangfire.

174. Drill and Firing

a. The piece is kept unloaded except when firing is imminent.

b. Personnel on the ground will pass in rear of the carriage when they go from side to side.

c. Personnel must stay a safe distance from the breech to prevent injury when the piece recoils.

d. During firing, personnel should use cotton in their ears to protect eardrums against injury.

175. Safety Officer

In training, there must always be a safety officer for each artillery unit firing. For duties of the safety officer, see FM 6–40.

CHAPTER 14
TRAINING

Section I. GENERAL

176. Purpose and Scope

The purpose of this chapter is to present the requirements for training section personnel in the performance of their duties in service of the piece. It includes general information on the conduct of training and tests for the qualification of gunner.

177. Objectives

The objectives of training are to speed the attainment of proficiency by cannoneers in their individual duties and, through drill, to weld them into an effective, coordinated team that is able to function efficiently in combat. During training, the supervisor should keep in mind the proficiency sought by the appropriate Army Training Tests (ATT). Maximum efficiency is attained through regular drills.

178. Conduct of Training

a. Training will be conducted in accordance with the principles set forth in FM 21–5. The goal of training should be the standards set forth in FM 6–125, and AR 611–201.

b. In general, individual training is conducted by noncommissioned officers as far as practicable. Officers are responsible for preparing training plans, for conducting unit training, and for supervising and testing individual training.

c. Throughout training the application of prior instruction to current training must be emphasized.

d. A record of the training received by each individual in the section should be maintained on a progress card by the chief of section. This card should show each period of instruction attended, tests taken, and remarks pertaining to progress. Progress cards should be inspected frequently by the battery executive to make sure they are being kept properly and to determine the state of training. Requiring the chief of section to keep these records emphasizes his responsibility toward his section.

e. The necessity for developing leadership and initiative in noncommissioned officers must be emphasized constantly throughout training.

179. Standard To Be Attained

A satisfactorily trained weapon section must be capable of performing the following functions in the times indicated:

a. Firing. The section must fire 10 rounds (drill ammunition) at different deflections, elevations, and time fuze settings, using the same charge, in 10 minutes by day and 15 minutes by

night. Changes in data should be typical for a time bracket adjustment; data are announced from prepared cards.

b. After-Firing Care and Maintenance of Armament. The piece being in position, the section must clean and lubricate, disassemble the breech and firing mechanism, and inspect the weapon in 45 minutes by day and 60 minutes by night. All tools and materials required should be available at the position.

c. Six-Month Inspection and Maintenance of Armament. With the weapon prepared for action in the gun park, the section must clean and lubricate all parts and assemblies, as authorized, and prepare for ordnance inspection in 3 hours. All tools and materials required should be available in the gun park.

d. Section Drill. Each member of the section should know the duties of all other members of the section and be able to perform efficiently in each duty position. See paragraphs 191 through 200 for tests to be given for the qualification of gunners.

Section II. MINIMUM TRAINING SCHEDULE

180. General

The training schedule outlined in paragraph 182 is a guide to meet the minimum training requirements for personnel of a gun (howitzer) section in subjects covered in this manual.

181. Individual Periods

a. Individual periods of training in service of the piece should be arranged, along with other battery training, into a balanced training program, taking into consideration the basic principles of training.

b. In general, except for service practice, periods on any subject should not be longer than 1 hour. Section drill periods should be for only one-half hour and should be conducted in a vigorous manner.

c. Periods of drill should be preceded and followed by periods on subjects that are logically related to the drill. For example, a period of drill should be preceded by a period of testing and adjustment of sighting and fire control equipment and followed by a period of inspection and maintenance drills. A period on aiming post displacement correction may come between two periods of howitzer drill.

d. TM 9–2300–216–10 provides information on which to base periods of instruction on description, characteristics, and functioning of the piece; familiarization with the piece, including breech and firing mechanisms, barrel assembly and slides, recoil mechanism, equilibrator, elevating mechanism, and sighting and fire control equipment; and field assembly and malfunction. These periods should be included in the battery training schedule and closely allied with the training in service of the piece. Approximately 8 hours should be devoted to this instruction.

182. Training Schedule (78 Hours)

Method*	Hours	Subject	Text references	Training aids and equipment
C, D, PW	1	Organization and compositon of howitzer section, general duties of individuals, and formation of howitzer section.	Par. 2–8.	Howitzer and motor carriage.
C, D, PW	1	Posts and posting, changing posts, and mounting and dismounting.	Par. 9–14.	Do.
C, D, PW	2 (1-hour periods)	Prepare for action and march order.	Par. 15–18.	Do.
C, D, PW	24 (½-hour periods)	Howitzer drill, duties in firing by indirect laying.	Par. 19–88, 109, 114, 118.	TOE equipment.
C, D, PW	9 (½-hour periods)	Howitzer drill, duties in firing by direct laying.	Par. 89–107.	Do.

C, D, PW	6 (1-hour and ½-hour periods)	Test and adjustment of sighting and fire control equipment.	Par. 118–152.	TOE equipment.
C, D, PW	2 (½-hour periods)	Aiming post displacement correction.	Par. 111.	TOE equipment and blackboard and chalk.
C, D, PW	4 (1-hour periods)	Inspections and maintenance drills.	Par. 153–162.	TOE equipment.
C, D, PW	1	Decontamination of material --	Par. 153–166.	Decontamination and TOE equipment.
C, D, PW	1	Destruction of material to prevent use by the enemy.	Par. 167–170.	Demolition and TOE equipment.
C, D	1	Safety precautions ----------	Par. 171–175.	TOE equipment.
PW	16 (4-hour periods)	Service practice, firing by indirect laying.	Par. 19–88, 118–135.	Do.

Method*	Hours	Subject	Text references	Training aids and equipment
PW	4	Service practice, firing by direct laying.	Par. 89–107.	Do.
C, PW	6 (1-hour periods)	Review and tests of subjects previously covered.	All previous references.	Do.

*C—Conference; D—Demonstration; PW—practical work.

CHAPTER 15

TESTS FOR QUALIFICATION OF GUNNERS

Section I. GENERAL

183. Purpose and Scope

This section prescribes the tests to be given in the qualification of gunners. The purposes of the tests are to—

a. Provide a means of determining the relative proficiency of the individual artillery soldier in the performance of the duties of the gunner. *The tests will not be a basis for determining the relative proficiency of batteries or higher units.*

b. Serve as an adjunct to training.

184. Standards of Precision

The candidate will be required to perform the tests in accordance with the standards listed in *a* through *d* below.

a. Settings must be exact.

b. Level bubbles must be centered exactly.

c. The vertical crosshair in the reticle of the panoramic telescope must be alined on the left edge of the aiming post or on exactly the same part of the aiming point each time the piece is laid.

d. Final motions of the azimuth and elevation setting knobs, as well as the traversing handwheel and elevating mechanism, must be made in the appropriate direction (par. 108.).

e. The appropriate elevation correction must be set on the correction indicator dial.

185. Assistance

The candidate will receive no unauthorized assistance. Each candidate may select authorized assistants as indicated in the tests. If a candidate fails any test because of the fault of the examiner or any assistant, the test will be disregarded, and the candidate will be given another test of the same nature.

186. Time

The time for any test will be the time from the last word of the command to the last word of the candidate's report. The candidate may begin any test after the first word of the first command and should not be charged for any time used by the examiner.

187. Scoring

Scoring will be conducted in accordance with the two subparagraphs entitled *Penalties* and *Credits* under each subject. If a test is performed correctly, credit will be given in accordance with the subparagraph entitled *Credit* under each subject. No credit will be allowed if conditions exist as specified in the subparagraph entitled *Penalties.* No penalty will be assessed in excess of the maximum credit for each test.

188. Preparation for Tests

The piece will be prepared for action and the candidate posted at the proper position corresponding to the test being conducted or as indicated in the *Special Instructions* subparagraphs under each subject. The examiner will insure that the candidate understands the requirements of each test and will require the candidate to report "I am ready," before each test.

189. Qualification Scores

Minimum scores required for qualification in the courses are as follows:

Individual classification	*Points*
Expert gunner	90
First-class gunner	80
Second-class gunner	70

190. Outline of Tests

Par.	Subject	No. of tests	Points each	Maximum credit
191	Direct laying, direct fire telescope	4	2	8
192	Indirect laying, deflection only	18	2	36
193	Displacement correction	1		4
	Part I		(3)	(3)
	Part II		(1)	(1)
194	Measuring deflection	2	4	8
195	Laying for elevation, elevation counter	3	2	6

Par.	Subject	No. of tests	Points each	Maximum credit
196	Laying for elevation, gunner's quadrant	3	2	6
197	Measuring elevation	1	5	5
198	Measuring angle of site to mask	1	4	4
199	Sighting and fire control equipment	2	4	8
200	Materiel	3	5	15
	Total credit			100

Section II. TESTS

191. Direct Laying, Direct Fire Telescope

a. Scope of Tests. Four tests (two groups of two tests each) will be conducted in which the candidate will be required to execute commands similar to those given in *c* below. Tests 1 and 2 (and tests 3 and 4) will be executed as one series of commands.

b. Special Instructions.

(1) The *one-man, one-sight* systems will be used.

(2) A stationary target will be placed approximately 600 meters from the piece.

(3) The azimuth counter dial will be set at 3200 and the gunner's aid index will be set at zero and the elevation bubbles will be leveled.

(4) The candidate will be posted as the gunner.

(5) The piece will be pointed so that a shift of approximately 100 mils will be required for tests 1 and 3, and it will not be necessary to shift the motor carriage for any of the four tests.

(6) Laying at the termination of tests 1 and 3 will not be disturbed at the beginning of tests 2 and 4.

(7) The examiner will announce the assumed direction of the movement of the target before tests 1 and 3. The assumed direction of the movement of the target in test 3 will be opposite that in test 1.

c. Outline of Tests.

Test No.	Examiner commands (for example)	Action of candidate
1 and 3	TARGET, THAT TANK, FROM LEFT TO RIGHT LEAD 5, QUADRANT 25.	Sets the announced quadrant on the elevation counter dial. Insures that the appropriate setting is on the elevation correction indicator dial. Elevates or depresses the tube until the elevation level bubble is centered. Centers cross-level level bubble. Traverses tube until proper lead has been established.

Test No.	Examiner commands (for example)	Action of candidate
		Commands FIRE and steps clear.
2 and 4	RIGHT (LEFT) 6, UP (DOWN) 5.	Same as test 1 above.

d. Penalties. No credit will be allowed if, after each test—

(1) The azimuth counter setting has been moved from 3200.
(2) The gunner's aid index has been moved from zero.
(3) The elevation level and cross-level level bubbles are not centered.
(4) The proper setting is not on the elevation counter dial.
(5) The lead in mils is not set properly.
(6) The appropriate setting is not on the elevation correction indicator dial.

e. Credit.

Time in seconds, exactly or less than ---	8	8–2/5	9
Credit ----------	2.0	1.5	1.0

192. Indirect Laying, Deflection Only

a. Scope of Tests. Eighteen tests will be conducted in which the candidate will be required to execute commands similar to those given in *c* below. Tests 1 through 4 (and tests 5–9, and 14–18) will be executed as one series of commands.

b. Special Instructions.

(1) Commands will not necessitate movement of motor carriage.

(2) The examiner will select a suitable aiming point and identify it to the candidate.

(3) Commands for special corrections will be given *only* in the tests indicated in the examples given in *c* below.

(4) Commands for new deflections for each test will be within the following prescribed limits:

Test No.	Maximum change (mils)	Minimum change (mils)
2 and 11	180	140
3 and 12	90	70
4 and 13	40	20
7 and 16	100	60
8 and 17	50	30
9 and 18	20	10

(5) The piece will be laid with the correct settings at the conclusion of each test before proceeding with the next test.

(6) For these tests, aiming posts will be set out at prescribed deflection and distances.

(7) The examiner will designate the section number of the piece to be used and will announce, when applicable, special corrections in deflection to be applied by the candidate.

(8) The candidate will be posted as the gunner.

c. Outline of Tests.

Test No.	Examiner commands (for example)	Action of candidate
1 and 10	SPECIAL CORRECTIONS, DEFLECTION 3290, NUMBER 1, LEFT 7.	Sets deflection and applies special correction. Centers leveling bubbles. Traverse piece until vertical cross hair is on left edge of aiming posts. Checks centering of level bubbles. Re-lays if necessary. Calls "Ready" and steps clear.
2 and 11	DEFLECTION 3153_	Sets deflection. Lays on aiming posts. Checks centering of level bubbles. Re-lays if necessary. Calls "Ready" and steps clear.
3 and 12	DEFLECTION 3236_	Same as test 2 above.
4 and 13	NUMBER 1, RIGHT 4. At conclusion of test 4 (13) give END OF MISSION. (No time considered for this operation.)	Same as test 2 above.

Test No.	Examiner commands (for example)	Action of candidate
5 and 14	AIMING POINT, CHURCH STEEPLE (or such-and-such), REFER.	Refers telescope to church steeple. Reads deflection on azimuth counter dial and calls "NUMBER 1, deflection (so much)."
6 and 15	DEFLECTION 3000, REFER.	Sets deflection on azimuth counter. Verifies that vertical cross-hair of the reticle is on appropriate part of church steeple. Calls "Number 1, deflection 3000." Steps clear.
7 and 16	SPECIAL CORRECTIONS, DEFLECTION 3080. NUMBER 1, LEFT 7.	Same as test 1 above.
8 and 17	DEFLECTION 3120.	Same as test 2 above.
9 and 18	DEFLECTION 3135.	Same as test 2 above.

d. Penalties. No credit will be allowed if, after each test—

(1) The deflection is not set correctly.

(2) The level bubbles are not centered.

(3) The vertical crosshair of the telescope is not on the aiming point or left edge of aiming posts, as the case may be.

(4) The last motion of the traverse was not made to the right.

e. Credit. Time in seconds, exactly or less than—

Tests 1, 7, 10, and 16, each	12	13	14
Other tests, each	8	9	10
Credit	2.0	1.5	1.0

193. Displacement Correction

a. Scope of Test. One test, consisting of two parts, will be conducted in which the candidate will be required to execute the commands given in *c* below.

b. Special Instructions.

(1) Aiming posts will be set out at prescribed distances.

(2) An assistant, selected by the candidate, will be stationed near the far aiming post.

(3) The examiner will require the candidate to lay the piece on an announced deflection and report, "I am ready."

(4) The motor carriage or the far aiming post will then be moved so that an aiming post displacement of 5 to 10 mils occurs.

(5) The laying of the piece at the termination of part I will not be disturbed for part II.

c. Outline of Test.

(1) *Part I.*

Examiner commands	Action of candidate
CORRECT FOR DISPLACEMENT.	Lays the piece so that the far aiming post appears midway between the near aiming post and the vertical crosshair of the telescope. Checks centering of level bubbles. Re-lays if necessary. Calls "Ready" and steps clear.

(2) *Part II.*

Examiner commands	Action of candidate
ALINE AIMING POSTS--	Sets 3200 on the azimuth reset counter dial and directs assistant in alining aiming posts. Calls "Ready" and steps clear.

d. Penalties. No credit will be allowed for either part if—

(1) *Part I.*

(*a*) The far aiming posts does not appear midway between the near aiming post and the vertical crosshair of the telescope.

(*b*) The bubbles are not centered.

(*c*) The last motion of traverse was not made to the right.

(2) *Part II.*

(*a*) The deflection indicated on the azimuth reset counter dial is not 3200.

(*b*) The aiming posts are not properly alined.

(*c*) The vertical crosshair of the telescope reticle is not on the left edge of the aiming posts.

e. Credit.

Part I, time in seconds, exactly or less than	3	3⅓	3⅔	4
Credit	3.0	2.0	1.5	1.0
Part II, no time limit				
Credit	1.0	---	---	---

194. Measuring Deflection

a. Scope of Test. Two tests will be conducted in which the candidate will be required to measure and report a deflection in accordance with the commands given in *c* below.

b. Special Instructions.

(1) The piece will be laid on aiming posts to the left front.

(2) The examiner will select two aiming points: the aiming point for test 1 will be within 200 mils to the left or right of the aiming posts, and the aiming

point for test 2 will be within 200 mils on the opposite side of the aiming posts.

(3) The appropriate aiming point will be designated by the examiner and identified by the candidate prior to the start of each test.

c. *Outline of Tests.*

Test No.	Examiner commands	Action of candidate
1	NUMBER 1, AIMING POINT, CHURCH STEEPLE TO LEFT FRONT, REFER.	Centers the level bubbles. Refers to aiming point. Checks centering of bubbles. Reads deflection from the azimuth counter dial and reports, "NUMBER (so and so) deflection (so much)" and steps clear.
2	NUMBER 1, AIMING POINT, WATER TOWER, RIGHT FRONT, REFER.	Same as test 1 above.

d. *Penalties.* No credit will be allowed if—

(1) The level bubbles are not centered properly.

(2) The vertical crosshair of the telescope reticle is not on the aiming point properly.

(3) The deflection is not announced correctly.

(4) The traversing handcrank is turned.

e. Credit.

Time in seconds, each test, exactly or less than	5	5⅘	6	6⅘
Credit	4.0	3.0	2.0	1.5

195. Laying for Elevation, Elevation Counter

a. Scope of Test. Three tests will be conducted in which the candidate will be required to execute commands similar to those in *c* below.

b. Special Instructions.

(1) Each test will require a change of settings and the accompanying laying of the piece in elevation. (All commands will be within the limits of 200 to 400 mils on the elevation counter.)

(2) Commands for elevation in test 2 and 3 will not be made in multiples of 5 mils.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	ELEVATION 290	Sets announced elevation. Elevates or depresses the tube. Checks level bubbles. Calls "Ready."
2	ELEVATION 326	Same as test 1 above.
3	ELEVATION 323	Same as test 1 above.

d. Penalties. No credit will be allowed if after each test—

(1) The elevation counter is not set accurately.

(2) The level bubbles are not centered accurately.

(3) The appropriate correction is not set on the elevation correction indicator dial.

(4) The last motion of the tube was not in the direction in which it is most difficult to turn the elevating handwheel.

e. Credit.

Time in seconds, exactly or less than	6⅗	7⅗	8⅗
Credit	2.0	1.5	1.0

196. Laying for Elevation, Gunner's Quadrant

a. Scope of Tests. Three tests will be conducted in which the candidate will be required to execute commands similar to those in *c* below.

b. Special Instructions.

(1) The gunner's quadrant will be set at zero for the first test.

(2) Each succeeding test will require a change of quadrant setting within the limits of 30 to 60 mils.

(3) The candidate will be posted to the right of and facing the breech with the gunner's quadrant in his hand.

(4) An assistant, selected by the candidate, will be posted to operate the elevating handwheel.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	QUADRANT 190_____	Sets elevation on gunner's quadrant and seats quadrant. Has assistant elevate or depress the tube until quadrant bubble is centered. Calls "Ready," and waits for examiner to verify laying.
2	QUADRANT 245_____	Same as test 1 above.
3	QUADRANT 215_____	Same as test 1 above.

d. Penalties. No credit will be allowed if, after each test—

(1) The quadrant elevation is not set correctly.

(2) The quadrant is not properly seated.

(3) The quadrant bubble is not properly centered.

e. Credit.

Time in seconds, exactly or less than _____	6	6⅗	7
Credit _____	2.0	1.5	1.0

197. Measuring Elevation

a. Scope of Test. One test will be conducted in which the candidate will be required to measure the elevation by means of the gunner's quadrant.

b. Special Instruction. Prior to the test the examiner will lay the tube at a selected elevation, measure the elevation, and set the gunner's quadrant at zero.

c. Outline of Test.

Examiner commands	Action of candidate
MEASURE THE ELEVATION.	Places gunner's quadrant on the quadrant seats of the breech ring. Levels bubble by raising or lowering the index arm and turning the micrometer knob. Announces "Number (so-and-so) elevation (so much)," and hands quadrant to the examiner.

d. Penalties. No credit will be allowed if—

(1) The quadrant bubble is not centered when the quadrant is seated properly.

(2) The elevation is not announced correctly.

e. Credit.

Time in seconds, exactly or less than	8	9⅖	10⅗
Credit	5.0	3.5	2.0

198. Measuring Angle of Site to Mask

a. Scope of Test. One test will be conducted in which the candidate will be required to execute the command in *c* below.

b. Special Instructions.

(1) The piece, prepared for action, will be placed 200 to 400 meters from a mask of reasonable height.

(2) The tube will be pointed so that it is 100 to 150 mils above the crest and 100 to 150 mils right or left of the highest point of the crest.

(3) The candidate will be posted at the right rear of the breech with gunner's quadrant in his hand.

(4) An assistant, selected by the candidate, will be posted as gunner to elevate or depress and traverse the tube as directed by the candidate.

c. Outline of Test.

Examiner commands	Action of candidate
MEASURE ANGLE OF SITE TO MASK.	Sights along lowest element of the bore, and has the tube moved until the line of sight just clears the highest point of the crest. Rotates the elevation knob until the level bubbles are level. Reads elevation from elevation counter. Reports, number (so-and-so), angle of site to the mask (so much)."

d. Penalties. No credit will be allowed if—

(1) The line of sight along the lowest element of the bore does not just clear crest.

(2) The quadrant bubble is not centered when the quadrant is properly seated.

(3) The appropriate correction is not set on the elevation correction indicator dial.

(4) The angle of site is not announced correctly.

e. Credit.

Time in seconds, exactly or less than	15	16	17	18
Credit	4.0	3.0	2.0	1.5

199. Sighting and Fire Control Equipment

a. Scope of Tests. Two tests will be conducted in which the candidate will be required to demonstrate the methods employed in making the prescribed tests and authorized adjustments or to describe the action taken (i.e., send to the ordnance maintenance company) if adjustment is not authorized to be made by using personnel.

b. Special Instructions. The piece will be prepared for action with the trunnions level and the tube in center of traverse.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	PERFORM END-FOR-END TEST ON GUNNER'S QUADRANT.	Performs test as prescribed in paragraph 139. Calls "Error (so many) mils, quadrant serviceable (unserviceable)" and hands quadrant to examiner for verification.

Test No.	Examiner commands	Action of candidate
2	PERFORM MICROMETER TEST ON GUNNER'S QUADRANT.	Performs test as prescribed in paragraph 140. Calls "Quadrant micrometer is (is not) in error." States what action, if any, should be taken.

d. Penalties.

(1) *General.* The tests are not essentially speed tests. The purpose of the prescribed time limits is to insure that the candidate can perform the operation without wasted effort.

(2) *Test 1.* No credit will be allowed if—

(*a*) The bubble of the gunner's quadrant does not center when verified by the examiner.

(*b*) The error (one-half of the amount of the angle which was indicated when the quadrant first was reversed and the bubble centered by moving the index arm and micrometer) is not announced correctly by the candidate.

(*c*) The candidate does not declare the quadrant unserviceable if the error (necessary correction) exceeds 0.4 mil or does not declare the quadrant serviceable if the error (necessary correction) is 0.4 mil or less.

(*d*) The time to complete the test exceeds 2 minutes.

(3) *Test 2.* No credit will be allowed if—

(*a*) The procedure is not followed correctly.

(*b*) The time to complete the test exceeds 1 minute.

(*c*) The candidate fails to report necessary action to be taken.

e. Credit. If the tests and adjustments are performed correctly within the prescribed time limits, maximum credit will be given as follows:

Test 1	4
Test 2	4
Total	8

200. Materiel Test

a. Scope of Tests. The candidate will be required to perform three tests as prescribed in *c* below.

b. Special Instructions.

(1) *Tests 1 and 2.* For tests 1 and 2, a paulin will be placed on the firing platform for the convenience of the candidate in laying out the disassembled parts. The candidate will be allowed to select the tools and accessories necessary for the performance of the tests prior to the start of the tests. The candidate may have an assistant to aid him in lowering and lifting the breechblock.

(2) *Test 3.* A complete set of lubrication equipment authorized for use of battery

personnel, including lubrication order, will be made available on a nearby paulin. Every type of lubricant used on the piece will be available in plainly labeled containers and placed on the paulin.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	DISASSEMBLE BREECH AND FIR-MECHANISM.	Performs the operation as described in TM–2300–216–10, laying the disassembled parts on the paulin. After disassembly, identifies all parts to examiner.
2	ASSEMBLE BREECH AND FIRING MECHANISM	Performs the operation as described in TM 9–2300–216–10.
3	PERFORM DAILY, WEEKLY, AND MONTHLY LUBRICATION TEST.	Using the lubrication order as a guide, selects proper lubrication equipment and lubricant and shows *how, when,* and with *which lubricant* each lubrication point on the piece is serviced (actual lubrication is not performed).

d. Penalties.

(1) The tests are not essentially speed tests. The purpose of the maximum time limits is to insure that the candidate can per-

form the operations without wasted effort.

(2) No credit will be given if the following time limits are exceeded:

Test 1	12 minutes
Test 2	16 minutes
Test 3	5 minutes

(3) A penalty of one-half point will be assessed for each component part that is not correctly identified or omitted in test 1. There is no time limit imposed on the identification of component parts. However, the examiner may reduce the grade if it becomes obvious that the candidate is not familiar with the correct nomenclature.

(4) A penalty of one-half point will be assessed for each lubrication point missed or lubricated improperly and for each time the proper lubricating device or proper lubricant is not selected.

e. Credit.

(1) The candidate will be scored on the general merit of his work in addition to the specific requirements in *c* above.

(2) If each test is performed correctly within the prescribed time limit, maximum credit will be given as follows:

Test 1	5 points
Test 2	5 points
Test 3	5 points
Total	15 points

APPENDIX

REFERENCES

AR 320–5	Dictionary of United States Army Terms.
AR 320–50	Authorized Abbreviations and Brevity Codes.
AR 385–63	Regulations for Firing Ammunition for Training, Target Practice, and Combat.
AR 611–201	Manual of Enlisted Military Occupational Specialties.
AR 672–5–1	Awards.
AR 750–5	Maintenance of Supplies and Equipment.
ATP 6–100	Army Training Program for Field Artillery Units.
ATT 6–16	Field Artillery Battalions, 8-Inch Howitzer.
ATT 6–137	Field Artillery Howitzer Battery, 8-Inch, Infantry Division.
DA Pam 108–1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings.

DA Pam 310-Series	Military Publications Indexes.
FM 5–15	Field Fortifications.
FM 5–20	Camouflage, Basic Principles and Field Camouflage.
FM 5–25	Explosives and Demolitions.
FM 6–40	Field Artillery Cannon Gunnery.
FM 6–125	Qualification Tests for Specialists, Field Artillery.
FM 6–140	The Field Artillery Battery.
FM 21–5	Military Training.
FM 21–30	Military Symbols.
FM 21–40	Small Unit Procedures in Nuclear, Biological, and Chemical Warfare.
FM 22–5	Drill and Ceremonies.
FM 23–65	Browning Machine Gun, Caliber .50, HB, M2.
FM 25–10	Motor Transportation, Operations.
TM 3–220	Decontamination.
TM 9–238	Deep Water Fording, Ordnance Materiel.
TM 9–575	Auxiliary Sighting and Fire Control Equipment.
TM 9–1300–203	Ammunition for Antiaircraft, Tank, Antitank, and Field Artillery Weapons.
TM 9–1527	Gunner's Quadrants M1 and M1918 and Machine Gun Clinometer M1917.
TM 9–1900	Ammunition, General.

TM 9–2300	Artillery Materiel and Associated Equipment.
TM 9–2300–216–10	Gun, Self-Propelled, Full Tracked, 175-mm, M107, and Howitzer Self-Propelled, Full Tracked, 8-inch, M110.
TM 21–300	Driver Selection and Training (Wheeled Vehicle).
TM 21–301	Driver Selection, Training, and Supervision; Tracked Vehicles.
TM 21–305	Manual for the Wheeled Vehicle Driver.
TM 21–306	Manual for the Full-Track Vehicle Driver.
TM 38–750	Army Equipment Record System and Procedures.
TOE 6–418E	Field Artillery Howitzer Battery, 8-inch Self-Propelled.
TOE 6–437E	Field Artillery Gun Battery, 175-mm, Self-Propelled.

INDEX

	Paragraphs	Page
Accuracy in laying	108	68
Adjustment and disassembly	34, 154	32, 115
Agents, decontamination:		
Chemical	164	120
Biological and radiological	165	121
Aiming points	109	68
Aiming posts	110	69
Alining aiming posts	40, 110	35, 69
Ammunition:		
Care	116	78
For direct fire	93	55
Restoring	36	32
Safety precautions	172	125
Assistant gunner, duties:		
Direct laying	104	63
General	6	8
Indirect laying	21, 47	26, 37
Basic periodic tests:		
General	136	103
Preliminary conditions	137	104
Bore clear, to call	61	42
Breech, opening and closing	59	41
Boresighting:		
Aiming circle method	132	93
Distant aiming point method	126	87
During darkness	112	73
General	118	81
Standard angle method	128	88

	Paragraphs	Page
Boresight marks	133	94
Call off, the command	9	14
Cannoneers, duties:		
Direct laying	89, 107	52, 67
General	6	8
Indirect laying:		
No. 1	21, 52	26, 39
No. 2	21, 57	26, 41
No. 3	21, 62	26, 42
No. 4	21, 62	26, 42
No. 5	21, 67	26, 43
No. 6	21, 73	26, 47
No. 7	21, 77	26, 47
No. 8	21, 81	26, 50
Care of ammunition	116	78
Cease firing, the command	113	75
Change posts, the command	11	16
Changes in data	43, 114	36, 76
Chief of section, duties:		
Direct laying	96	58
General	6	8
Indirect laying	20	24
Maintenance	157	116
Commands	9, 24, 102	14, 27, 61
Common deflection	42	35
Conduct of drill	7, 19	13, 24
Data board, section	117	79
Decontamination	164	120
Definitions	2	3
Destruction of equipment	167	123
Direct fire table	100	60
Direct fire telescope	124	86
Direct laying, general:		
Two-man, two-sight system	89, 104	52, 63
Two-man, one-sight system	89, 105	52, 66
One-man, one-sight system	89, 106	52, 66
Dismount	13	20

	Paragraphs	Page
Displacement of aiming posts	46, 111	37, 71
Distant aiming point	109	68
Drives, duties:		
Direct laying	107	67
General	6	8
Indirect laying	21, 85	26, 51
Maintenance	88, 157	51, 116
Duties of personnel:		
Direct laying	89	52
General	6	8
Indirect laying	21	26
March order	17	22
Maintenance	157	116
Prepare for action	16	21
Elevation counter:		
Elevation quadrant M15	123, 149	86, 112
Telescope Mount M137	123, 148	86, 112
Elevation, laying for	29, 41, 49	29, 35, 37
Elevation quadrant M15:		
Test	149	112
Equipment, description of	3	4
Errors in section drill	8	13
Fall out, the command	14	20
Field of fire	91	53
Firing lanyard	60	41
Firing with reduced personnel	9	14
Formations	9	14
Functioning of materiel	32	31
Fuzes	68, 93	43, 55
Fuze setter:		
General	70	40
Test of	150	113
Gunner, duties:		
Direct laying	104	63
General	6	8
Indirect laying	21, 37	26, 33
Maintenance	157	116

	Paragraphs	Page
Gunner's quadrant:		
Comparison test	141	107
Correction	142	107
End-for-end test	139	105
General	138	105
Micrometer test	140	106
Identifying the target	98	59
Indicating the aiming point	22	26
Indirect laying	19	24
Inspections and maintenance	157	116
Laying for direction, indirect fire	39	33
Laying for elevation	29, 41	29, 35
Lead, direct fire	101	60
Leveling trunnions	121	83
Light, aiming post	110	69
Loader-rammer	53, 55	39, 40
Loading tray	63	42
Maintenance:		
After operation	161	118
Before operation	158	117
During halt	160	118
During operation	159	118
General	153, 179	115, 129
Weekly	162	119
March order	17	22
Measuring elevation	30	30
Methods of boresighting	121	83
Misfires	173	126
Mount, the command	12	18
Movement of motor carriage	35	32
Panoramic telescope:		
Alinement	125	87
Test	147	111
Parallax	129	89
Positioning weapons	15	21
Posting the section	10	16

	Paragraphs	Page
Posts of the section:		
Dismounted	10	16
Mounted	12	18
Prepared for action	10	16
Powder charges	54, 78, 116	39, 47, 78
Prearranged fires	31	31
Precision in laying	108	68
Prepare for action	16	21
Preparing ammunition	66	43
Plumb line	120	82
Primers	61, 116	42, 78
Radius point	133	94
Range card	90	53
Range to target, direct laying	99	60
Ready, to call	44	36
Recording data	28	28
Records:		
Maintenance	155	115
Training	181	131
References	4	4
Reference lines, testing target	112	73
Refering the panoramic telescope	45	36
Reporting errors	27	28
Rotation of duties	8	13
Safety, general	171, 174	125, 127
Safety officer	175	127
Section, composition of	5	8
Section drill:		
General instructions	8	13
Objectives	7	13
Section equipment	5	8
Set, to call	50	38
Setting fuzes	69	43
Short displacements	18	22
Site to mask	23	26
Stand fast, the command	12	18

	Paragraphs	Page
Stadia method, aiming posts	110	69
Supervision of drill	8	13
Targets, direct fire	92	54
Telescope mount M137	143	107
Terms	2	3
Tests for qualification of gunners:		
Direct laying	191	138
Displacement correction	193	144
General	183	135
Indirect laying	192	140
Laying for elevation, elevation counter	195	148
Laying for elevation, gunner's quadrant	196	149
Materiel	200	155
Measuring deflection	194	146
Measuring elevation	197	150
Measuring site to mask	23, 198	26, 151
Outline of	190	137
Preparation	188	137
Scores	189	137
Sighting and fire control equipment	199	153
Testing target	112, 118	73, 81
Testing target method of boresighting	122	84
Tools for boresighting	119	82
Training:		
General	176	128
Records	181	131
Schedule	180, 182	130, 132
Trajectories	94	56
Time fuze	70	44
Unloading the piece	115	76
Vertical displacement	95	58
VT fuze	70	44

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

DCSPER (2)
DCSLOG (2)
ACSI (2)
DCSOPS (2)
ACSRC (2)
CRD (1)
COA (1)
CINFO (1)
TIG (1)
TAG (1)
TJAG (1)
TPMG (1)
TSG (1)
CofEngrs (1)
CofT (1)
CSigO (1)
ARADCOM (2)
ARADCOM Rgn (2)
LOGCOMD (1)
Armies (5)
Corps (15)
Div (10)
Bde (1)
Regt/Gp (1) except
FA Regt/Gp (5)
Inf BG (1)
FA Bn (1) except
TOE: 6-415 (5)
6-435 (5)
FA Co/Btry (1) except
TOE: 6-418 (8)
6-419 (8)
6-437 (7)
6-439 (8)
Instl (2)
USMA (50)
Svc Colleges (8)
Br Svc Sch (8) except
USAAMS (1066)
Cen (5)
Units org under fol TOE:
17-22 (1)

NG: TOE: 6-401 (4); 6-415 (2); 6-418 (1); 6-419 (1); 6-501 (4).

USAR: Same as Active Army except allowance is one copy to each unit.

For explanation of abbreviations used, see AR 320-50.

S/S May 68

FIELD MANUAL
175-MM GUN M107, SELF-PROPELLED, AND 8-INCH HOWITZER M110 SELF-PROPELLED

FM 6-94
CHANGE No. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *17 September 1963*

FM 6-94, 5 November 1962, is changed as follows:

6. General Duties of Personnel

a. Chief of Section. The Chief of * * * battery executive for—

* * * * *

(6) (Superseded) Maintenance of Equipment Log Book (TM 38-750).

* * * * *

110. Aiming Posts

a. Two aiming posts are used for each piece. Each aiming post is equipped with a reflector for use at night. The most desirable distance from the piece to the far aiming post is 100 meters, considering accuracy of laying, visibility, and ability to control the aiming post reflectors. First, the far * * * as measuring devices (*d* below).

b. For night use, the aiming post reflectors should be adjusted so that the far reflector will appear above the near reflector. On flat terrain * * * near aiming post. The two reflectors placed in this manner will establish a vertical line for laying the piece.

* * * * *

125. Panoramic Telescope Alinement

Rotate the elevation * * * is at zero). The azimuth counter dial should now read 3,200 mils. **If the reading is not 3,200 mils, turn the boresight adjustment shaft until 3,200 appears in the counter window.**

131. Procedure

After the standard * * * are as follows:

a. (Superseded) Verify that the parts that move in recoil are in the same position with respect to the nonrecoiling parts as they were when the standard angles were determined.

* * * * *

134. Procedure — Trunnions Level

The howitzer having * * * method as follows:

* * * * *

f. (Superseded) Verify that the azimuth counter reads 3,200, and that the gunner's aid counter reads zero.

i. (Superseded) Refer the panoramic telescope to the exact center of the objective lens of the aiming circle.

j. (Superseded) The reading on the azimuth counter dial of the panoramic telescope should coincide with the reading on the aiming circle. If the reading on the azimuth counter dial does not coincide with the reading on the aiming circle, turn the boresight adjustment shaft until the reading as indicated on the aiming circle appears in the azimuth counter window. The optical axis of the panoramic telescope will now be parallel with the tube when deflection 3,200 is set on the telescope.

155. Records

(Superseded)

The principal records pertaining to the weapon are the Equipment Log Book, DA Form 2404 (Equipment Inspection and Maintenance Worksheet), and DA Form 2407 (Maintenance Request. For detailed information on the use of these forms, see TM 38–750.

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

DCSPER (2)
DCSLOG (2)
ACSI (2)
DCSOPS (2)
ACSRC (2)
CRD (1)
COA (1)
CINFO (1)
TIG (1)
TAG (1)
TJAG (1)
TPMG (1)
TSG (1)
CofEngrs (1)
CofT (1)
CSigO (1)
ARADCOM (2)
ARADCOM Rgn (2)
LOGCOMD (1)
Armies (5)
Corps (15)
Div (10)
Bde (1)
Regt/Gp (1) except
FA Regt (5)
Inf BG (1)
FA Bn (1) except
TOE 6-415 (5)
6-435 (5)
FA Co/Btry (1) except
TOE 6-418 (8)
6-419 (3)
6-437 (7)
6-439 (3)
Instl (2)
USMA (50)
Svc Colleges (3)
Br Svc Sch (3) except
USAAMS (1066)
Cen (5)
TOE 17-22 (1)

NG: TOE 6-401 (4); 6-415 (2); 6-418 (1); 6-419 (1); 6-501 (4).

USAR: Same as active Army, except allowance is one copy to each unit.

For explanation of abbreviations used, see AR 320-50.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1963

Table II. (Superseded) *Duties in March Order*

Sequence	Chief of section	Gunner	Assistant gunner	Number 1	Number 2	Number 3	Number 4	Number 5	Number 6	Number 7	Number 8	Motor carriage driver	Section vehicle driver
1	Commands MARCH ORDER. Supervises members of section throughout all sequences.	Sets telescope and mount to travel position. Positions tube in center of traverse.	Depresses tube to travel position and sets elevation quadrant to travel position.	Rotates loader-rammer to stowed position. Locks left traveling lock in traveling position.	Inspects the chamber to insure that piece is not loaded and closes the breech. Locks right traveling lock in traveling position.	Assists in loading ammunition and equipment.		Recovers wire and stows communication equipment.	Recovers aiming posts.		Guides section vehicle into position and assists in loading ammunition and equipment.	Starts engine of motor carriage and checks gages for proper functioning.	Drives vehicle to section area and assists in loading ammunition and equipment.
2			Retracts the tube to traveling position (175-mm gun only). Releases elevation hand-brake.	Passes primers to No. 7.	Passes swab bucket and swab to No. 4.		Receives swab bucket and swab from No. 2.	Assists in loading ammunition and equipment.	Passes covers to appropriate members of section and replaces muzzle plug.	Receives primers from No. 1.		Unlocks lockout suspension.	
3	Directs motor carriage drivers to move carriage forward to unseat spades.						Recovers paulin from left rear.		Assists in loading ammunition and equipment.	Recovers paulin from right rear of piece.		Moves motor carriage forward as directed by the chief of section.	
4		Replaces telescope cover.	Replaces elevation quadrant cover.	Replace breech cover.		Attaches ammunition and section equipment to the spade assisted by No. 4, 7, and 8.	Assists in attaching ammunition and section equipment to the spade.			Assists in attaching ammunition and section equipment to the spade.	Assists in attaching ammunition and section equipment to the spade.		
5	Elevates spade to travel position and locks left spade lock.	Turns oil pump motor switch to OFF.		Locks right spade lock.									
6	Verifies that the piece is prepared for traveling and reports to the executive SIR, NUMBER (SO-AND-SO) IN ORDER or report any defects that the section cannot remedy without delay.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.		

Table I. Duties in Preparing for Action

Sequence	Chief of section	Gunner	Assistant gunner	Number 1	Number 2	Number 3	Number 4	Number 5	Number 6	Number 7	Number 8	Motor carriage driver	Section vehicle driver
1	Commands PREPARE FOR ACTION. Supervises operations throughout all sequences.	Turns oil pump motor switch to ON position. Removes telescope cover.	Releases right travel lock. Removes elevation counter cover.	Remove breech cover.				Lays wire to the executives post.	Removes muzzle cover.		Guides section vehicle into position for unloading ammunition.	Releases left travel lock.	Drives vehicle into position and assists in unloading ammunition.
2	Releases left spade lock and lowers spades. Checks oil index on recuperator cylinder.		Extends tube to firing position after travel locks have been released (175-mm gun only) and elevates the tube to loading position.	Releases right spade lock.	Receives swab bucket and swab from No. 4.	Removes ammunition and section equipment from spades assisted by No. 4, 7, and 8.	Assists in removing ammunition and section equipment from spades and passes swab bucket and swab to No. 2.		Gathers covers and places them to the rear of the piece.	Assists in removing ammunition and section equipment from spades.	Assists in removing ammunition and section equipment from spades.		
3	Reports to the executive, SIR, NUMBER (SO-AND-SO) READY TO BE LAID.	Sets the announced deflection on the azimuth counter dial and directs the motor carriage driver in shifting the motor carriage if necessary to lay for direction.	Insures that the proper setting is on the correction indicator dial of the elevation quadrant.		Opens the breech and inspects the tube, breech block, primer vent, and gas check pad. Cleans and oils parts as required.	Positions machinegun in direction of probable area of responsibility for defense.	Procures and spreads paulin to right rear of the piece.	Prepares fuze setters.	Assembles aiming posts and moves them to positions 50 and 100 meters to the left front of the piece.	Procures and spreads paulin to left rear of the piece.	Assists in unloading ammunition	Shifts the motor carriage as directed by the gunner.	
4	Directs motor carriage driver to back vehicle until spades are seated.			Receives primers from No. 7.		Assists in unloading and preparing ammunition.				Procures primers and passes them to No. 1 and assists in unloading and preparing ammunition.		Backs vehicle as directed by the chief of section.	
5		Lays for direction and directs No. 6 in setting out aiming posts.		Moves loader-rammer to the rear and lowers loading arms.					Alines aiming posts as directed by the gunner.			Assists in unloading and preparing ammunition.	
6	Verifies that the piece is prepared for action and reports to the executive, SIR, NUMBER (SO-AND-SO) IN ORDER or reports any defects that cannot be corrected without delay by the section.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	After ammunition is unloaded, moves vehicle to point indicated by chief of section. Returns to the section or performs preventive maintenance as directed by the chief of section.

Table II. Duties in March Order

Sequence	Chief of section	Gunner	Assistant gunner	Number 1	Number 2	Number 3	Number 4	Number 5	Number 6	Number 7	Number 8	Motor carriage driver	Section vehicle driver
1	Commands MARCH ORDER. Supervises members of section throughout all sequences.	Sets telescope and mount to travel position.	Depresses tube to travel position and sets elevation quadrant to travel position.	Rotates loader-rammer to stowed position.	Inspects the chamber to insure that piece is not loaded and closes the breech.	Assists in loading ammunition and equipment.	Recovers and stows machine-gun.	Recovers wire and stows communication equipment.	Recovers aiming posts.		Guides section vehicle into position and assists in loading ammunition and equipment.	Starts engine of motor carriage and checks gages for proper functioning.	Drives vehicle to section area and assists in loading ammunition and equipment.
2			Locks right travel lock after tube has been retracted.	Passes primers to No. 7.	Retracts the tube to travel position (175-mm gun only) and passes swab bucket and swab to No. 4.		Receives swab bucket and swab from No. 2.	Assists in loading ammunition and equipment.	Passes covers to appropriate members of section and replaces muzzle cover.	Receives primers from No. 1.		Locks left travel lock after tube has been retracted.	
3	Directs motor carriage drivers to move carriage forward to unseat spades.						Recovers paulin from right rear.		Assists in loading ammunition and equipment.	Recovers paulin from left rear of piece.		Moves motor carriage forward as directed by the chief of section.	
4		Replaces telescope cover.	Replaces elevation quadrant cover.	Replace breech cover.		Attaches ammunition and section equipment to the spade assisted by No. 4, 7, and 8.	Assists in attaching, ammunition and section equipment to the spade.			Assists in attaching ammunition and section equipment to the spade.	Assists in attaching ammunition and section equipment to the spade.		
5	Elevates spade to travel position and locks right and left spade locks.	Turns oil pump motor switch to OFF.											
6	Verifies that the piece is prepared for traveling and reports to the executive SIR, NUMBER (SO-AND-SO) IN ORDER or report any defects that the section cannot remedy without delay.						Take posts.						

Table III. Duties in Firing

Sequence	Chief of section	Gunner	Assistant gunner	Number 1	Number 2	Number 3	Number 4	Number 5	Number 6	Number 7	Number 8	Motor carriage driver	Section vehicle driver
1	Directs work of section throughout all sequences.	Sets the announced deflection on the azimuth reset counter dial and centers the bubble in the cross-level level vial.	Sets the announced quadrant on the elevation counter dial and elevates or depresses the tube to the loading position.	After No. 2 has opened the breech, rotates the loader-rammer to the rear and lowers the loading arms.	Opens the breech and inspects the bore.	Installs the projectile on the loading tray assisted by No. 4.	Assists No. 3 in installing the projectile on the loading tray.	Fuzes the projectiles and sets fuzes assisted by No. 6.	Assists No. 5 in fuzing projectiles.	Prepares powder charges assisted by No. 8 and the motor carriage driver.	Assists No. 7 in preparing powder charges.	Assists in preparing powder charges.	Assists in preparing ammunition and powder charges.
2				Assisted by No. 2, moves the loading trough forward to the breech ring.	Assists No. 1 in moving the loading trough forward.	Assisted by No. 4, moves the projectile to the rear of the piece and attaches the loading tray to the loading arms.	Assists No. 3 in moving the projectile to the piece.						
3				Raises the loading tray and projectile to the loading trough and rams the projectile. Receives and loads the powder charge assisted by No. 2.	Assists No. 1 in loading the powder charge. Removes the loading tray after the powder charge has been loaded and passes it to No. 3.	Receives the loading tray from No. 2.				Moves the powder charge to the piece assisted by No. 8, passes it to No. 1, and calls out the number of the charge.	Assists No. 7 in moving the powder charge to the piece.		
4				Moves the loading trough to the rear assisted by No. 2, and rotates the loader-rammer to the stowed position.	Assists No. 1 in moving the loading trough to the rear and closes the breech when the loader-rammer has been stowed.								
				Inserts the primer and closes the primer lock.	Attaches the firing lanyard.								
5	Insures that the weapon is ready to fire. Indicates to the executive that the weapon is ready to fire by raising arm and/or announcing SIR, NUMBER (SO-AND-SO) READY.	Traverses the piece to the announced deflection, insures that the bubbles are centered, and announces (signals) READY after the assistant gunner has announced SET.	Elevates the piece to the announced quadrant, insures that appropriate settings are on the elevation quadrant and that bubbles are centered, and announces SET.										
6	On command of the executive, commands FIRE and/or lowers arm.				Fires the piece at the command of the chief of section.								
7			Elevates or depresses the tube to the loading position.		Opens the breech and checks to insure that the spent primer has been ejected. Swabs the powder chamber, inspects the bore and if clear, calls BORE CLEAR.								

Table VI. Duties in Inspection and Maintenance

Sequence	Chief of section	Gunner	Assistant gunner	Number 1	Number 2	Number 3	Number 4	Number 5	Number 6	Number 7	Number 8	Motor carriage driver	Section vehicle driver
1	Supervises activities of all members of the section in all sequences.	Inspects for condition, functioning and security of panoramic telescope and telescope mount.	Checks for condition, functioning, and security of elevation quadrant.	Remove breech cover and inspect for tears, wear, and broken or missing fasteners.		Inspects tools stowed on rear of spade and rear of hull. Checks towing pintle for cracks, breaks, and ease of operation.	Assists No. 3 in inspecting section equipment.	Checks machine-gun and emergency rations.	Check for proper stowage of ammunition and equipment on section vehicle and assists section vehicle driver in inspection and maintenance of the section.			Checks fuel oil, and transmission levels.	Inspects vehicle and performs maintenance as prescribed in applicable technical manual assisted by No. 6, 7, and 8.
2	Checks recoil system and directs No. 1 to service same if necessary.	Checks functioning of night lighting device for panoramic telescope.	Check and release right travel lock.	Turn hydraulic pump switch ON.	Services recoil system if directed to do so by the chief of section.	Check track tension of left track.	Check track tension of right track.					Checks and releases left travel lock.	
3	Verifies presence of technical manuals, lubricating order, and equipment log book.	Check battery for proper, electrolyte level, and cleanliness.	Checks functioning of night lighting device for elevation quadrant.		Extend tube to firing position and check for smoothness of operation (175-mm gun only).	Check fixed fire extinguisher on left side of the piece.	Assists motor carriage driver in inspecting operation of lights.					Check operation of lights and horn assisted by No. 4.	
4	Releases spade locks and lowers spade, checking for smoothness of operation.	Check operation of elevating and traversing controls.	Checks operation of elevating controls.	Check operation of loader-rammer.	Opens breech and checks breech block, chamber, and tube and closes breech.		Inspect vehicle hull and cleans periscopes.					Checks vehicle instruments and controls.	
5		Boresights the piece.	Assists the gunner in boresighting.		Check portable fire extinguisher.	Assists the gunner in boresighting the piece.						Checks fixed fire extinguisher in driver's compartment.	
6	Returns spade to travel position and lock spade locks.	Check fixed fire extinguisher on left top of carriage.	Locks right travel lock and checks fixed fire extinguisher on right top of carriage.		Retracts tube to travel position.							Locks left travel locks.	
7	Reports to the battery executive, SIR, NUMBER (SO-AND-SO) IN ORDER or reports any defects which the section cannot remedy without delay.	Reports "Gunner ready".	Reports "Assistant gunner ready".	Reports "No. 1 ready".	Reports "No. 2 ready".	Reports "No. 3 ready".	Reports "No. 4 ready".	Reports "No. 5 ready".	Reports "No. 6 ready".	Reports "No. 7 ready".	Reports "No. 8 ready".	Reports "Motor carriage driver ready".	Reports "Section vehicle driver ready".
						After Operation							
1	Supervise maintenance and inspection by all members of the section in all sequences.	Clean and test panoramic telescope and mount.	Clean and test elevation quadrant and mount.	Clean and lubricate loader-rammer.	Clean and lubricate breech mechanism.	Clean and lubricate tube.		Inspect, clean, and lubricate machinegun.	Check for proper stowage of ammunition and equipment on section vehicle and assist section vehicle driver in inspection and maintenance of the section vehicle.			Idles engine properly before stopping. Observes instruments and warning light while engine idles. Shuts off master switch. Checks fuel and oil levels. Looks for leaks in engine compartment. Checks spare containers for content. Checks fuel filters for leaks and drains high and low pressure filters. Operates lights and horn (if tactical situation permits). Cleans battery, checks water level, and inspects terminals for corrosion, tightness, and coating of grease. Completes vehicle operation record.	Inspects vehicle and performs maintenance as prescribed in applicable technical manual assisted by No. 6, 7, and 8.
2	Clean and test gunner's quadrant.	Cleans and tests traversing and elevating mechanisms on the left side of the carriage.	Cleans and tests elevating mechanisms on right side of the carriage.		Cleans, lubricates, and tests firing lock.	Checks track tension of left track and inspects road wheels and idler hubs for overheating.	Checks track tension of right track and inspects road wheels and idler hubs for overheating.	Inspect and clean communication equipment.					
3	Inspects recoil system and directs No. 1 to service same if necessary.	Assists chief of section in supervising maintenance.		Services recoil system if directed by the chief of section.		Inspect vehicle hull, spade locks, and towing pintle.	Cleans periscopes.	Checks emergency rations.					
4	Posts equipment log book and verifies the presence of all forms and manuals.				Inspect portable fire extinguisher.	Inspect and clean section equipment.							
5	Reports to battery executive, SIR, NUMBER (SO-AND-SO) IN ORDER, or reports any defects that cannot be corrected without delay.												

Table I. (Superseded) *Duties in Preparing for Action*

Sequence	Chief of section	Gunner	Assistant gunner	Number 1	Number 2	Number 3	Number 4	Number 5	Number 6	Number 7	Number 8	Motor carriage driver	Section vehicle driver
1	Commands PREPARE FOR ACTION. Supervises operation throughout all sequence. Releases left spade lock and lowers spade.	Turns oil pump motor switch to ON position. Removes telescope cover.	Raises personnel seat. Removes quadrant cover. Assists number 1 in removing breech cover.	Raises personnel seat. Removes breech cover and throws it to left rear of weapon. Releases right spade lock and lowers spade.		Removes section equipment and ammunition from spades. Places to left rear of piece assisted by numbers 4, 7, and 8.	Assists in removing ammunition and section equipment from spades and passes swab bucket and swab to number 2.	Laws wire to executive's post.		Assists in removing ammunition and section equipment from spades.	Guides section vehicle into position for unloading ammunition. Assists in removing ammunition and section equipment from spades.	Remains in driver's compartment until spades are seated.	Drives vehicle into position and assists in unloading ammunition.
2	Directs motor carriage driver to back vehicle until spade is seated. The spade must be dug in so that the full length of the tracks is on the ground. (Top curve of spade is parallel to ground and on ground level.)		Places retracting valve handle to RETURN position and extends tube to firing position after the spades have been dug in (175-mm gun only). ***Caution:*** **Traveling locks must be hooked when moving the tube in or out of battery.**									Backs vehicle as directed by chief of section. Turns lockout system to LOCK position. *SHUTS OFF MOTOR.*	
3		Depresses override switch on signal from assistant gunner. Releases override switch on signal from assistant gunner.	When tube is in battery, signal gunner to press override switch. Hold valve handle in RETURN position until recuperator index is extended 0.20 inches. Signals gunner to release override switch.		Measures from front end of replenisher cylinder to replenisher piston rod. If measurement is less than 4 inches, gunner and assistant gunner repeat sequence 3.				Gathers covers and places them with section equipment.				
4		Identifies aiming point when announced.	Moves manual elevating crank to assist in releasing travel locks. Elevates tube after travel locks are released.	Releases left traveling lock. Locks traveling lock in firing position.	Releases right traveling lock.	Assists in unloading and preparing ammunition.	Procures and spreads paulin to left rear of piece.	Prepares fuze setter.	Assembles aiming posts and places them with section equipment.	Procures and spreads paulin to right rear of piece.	Assists in unloading ammunition.		
5	Moves to left rear of vehicle and directs the driver in shifting the carriage if necessary. ***Caution:*** **Chief of section must raise spade before shifting carriage.**	Sets announced deflection on the azimuth counter dial. Signals chief of section for shifting the motor carriage if necessary to lay for direction.	Insures that the proper setting is on the correction indicator dial of the elevation quadrant.		Receives swab bucket and swab from number 4. Opens the breech and inspects the tube, breechblock, primer vent, and gas check pad. Runs swab in chamber to remove muzzle plug.		Assists in unload and preparing ammunition.	Assists in unloading and preparing ammunition.	Retrieves muzzle plug and places it with breech cover.	Assists in unloading and preparing ammunition.		Shifts the motor carriage as directed by chief of section.	
6		Lays for direction and directs No. 6 in setting out aiming posts.	Places tube at loading elevation.	Receives primers from No. 7.					Alines aiming posts as directed by the gunner.	Procures primers and passes them to number 1.			
7				Moves loader-rammer to the rear and lowers loading arm.								Assists in unloading and preparing ammunition.	
8	Verifies that the piece is prepared for action and reports to the executive SIR, NUMBER (SO-AND-SO) IN ORDER or reports any defects that cannot be corrected without delay.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	After ammunition is unloaded, moves vehicle to point indicated by chief of section. Returns to the section or performs preventive maintenance as directed by chief of section.

Table III. (Superseded) *Duties in Firing*

Sequence	Chief of section	Gunner	Assistant gunner	Number 1	Number 2	Number 3	Number 4	Number 5	Number 6	Number 7	Number 8	Motor carriage driver	Section vehicle driver
1	Directs work of section throughout all sequences.	Sets the announced deflection on the azimuth reset counter dial and centers the bubble in the cross-level level vial.	Sets the announced quadrant on the elevation counter dial and elevates or depresses the tube to the loading position.	After No. 2 has opened the breech, rotates the loader-rammer to the rear and lowers the loading arms.	Opens the breech and inspects the bore.	Installs the projectile on the loading tray assisted by No. 4.	Assists No. 3 in installing the projectile on the loading tray.	Fuzes the projectiles and sets fuzes assisted by No. 6.	Assists No. 5 in fuzing projectiles.	Prepares powder charges assisted by No. 8 and the motor carriage driver. When firing charge 1, the igniter tube should be removed, leaving the black powder igniter bag inside the charge (175-mm gun).	Assists No. 7 in preparing powder charges.	Assists in preparing powder charges.	Assists in preparing ammunition and powder charges.
2				Assisted by No. 2, moves the loading trough forward to the breech ring. ***Caution:*** **Do not swing rammer with projectile hanging from rack.**	Assists No. 1 in moving the loading trough forward.	Assisted by No. 4, moves the projectile to the rear of the piece and attaches the loading tray to the loading arms.	Assists No. 3 in moving the projectile to the piece.						
3	Directs hand ramming of the projectile when the power rammer fails. Insures that the springs in the loader-rammer are released so that the pins in the crank do not break.			Raises the loading tray and projectile to the loading trough and rams the projectile. (Open valve fully and keep open until projectile is seated. This provide uniform ramming.)	Receives powder charge from No. 7 and 8. Assisted by No. 1, loads the powder charge. (When firing charges 1 and 2, place powder so that it will be just forward of the mushroom head when the breech is closed.					Moves the powder charge to the piece assisted by No. 8, passes it to No. 1, and calls out the number of the charge.	Assists No. 7 in moving the powder charge to the piece.		
4				Moves the loading trough to the rear assisted by No. 2, and rotates the loader-rammer to the stowed position. (Keep rammer control handles covered when not in use.)	Assists No. 1 in moving the loading trough to the rear and closes the breech when the loader-rammer has been stowed.								
5	Insures that the weapon is ready to fire. Indicates to the executive that the weapon is ready to fire by raising arm and/or announcing SIR, NUMBER (SO-AND-SO) READY.	Traverses the piece to the announced deflection, insures that the bubbles are centered, and announces (signals) READY after the assistant gunner has announced SET.	Elevates the piece to the announced quadrant, insures that appropriate settings are on the elevation quadrant and that bubbles are centered, and announces SET.	Inserts the primer and closes the firing mech. Calls PRIMED.	Attaches the lanyard after tube has been traversed and elevated to proper deflection and elevation and the gunner calls READY.								
		Warning: **Position knees so that they are out of reach of the manual traverse and elevating cranks.**											
6	On command of the executive, commands FIRE and/or lowers arm.				Fires the piece at the command of the chief of section.								
7			Elevates or depresses the tube to the loading position.	No. 1 repeats step in number 1.	Opens the breech and checks to insure that the spent primer has been ejected. Swabs the powder chamber, inspects the bore and if clear, calls BORE CLEAR.	Assisted by No. 4 removes loading tray from loading arm.	Assists No. 3 in removing loading tray from loading arm.						
		Note. **Listen to electric motor for hydraulic pump. If it starts to drag, shut off all electrical equipment, and start engine to recharge batteries. Weapon may be fired with engine running.**											

PENTAGON LIBRARY
3000015747